Journal
OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION

AVMA Convention—San Antonio, Oct. 15-18, 1956

Symposium on Leptospirosis

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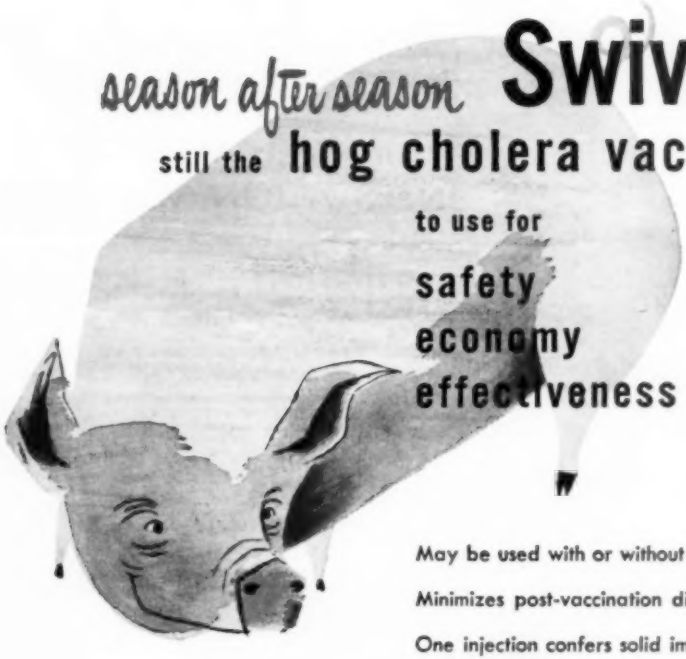

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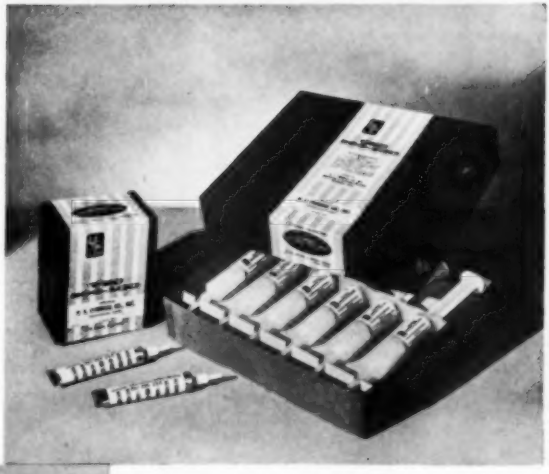

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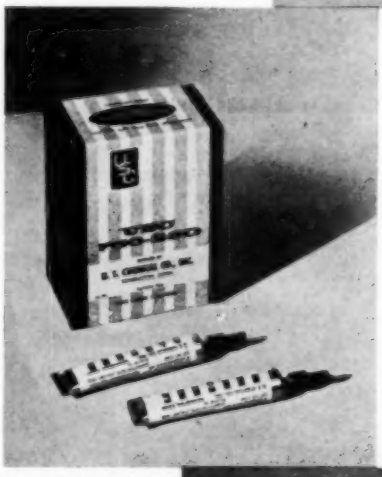

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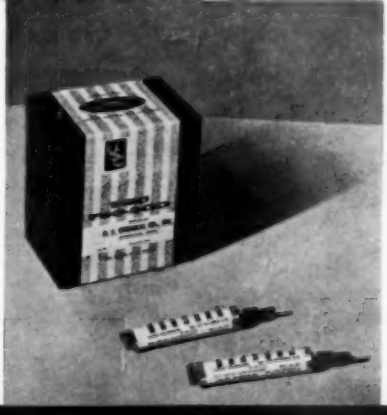

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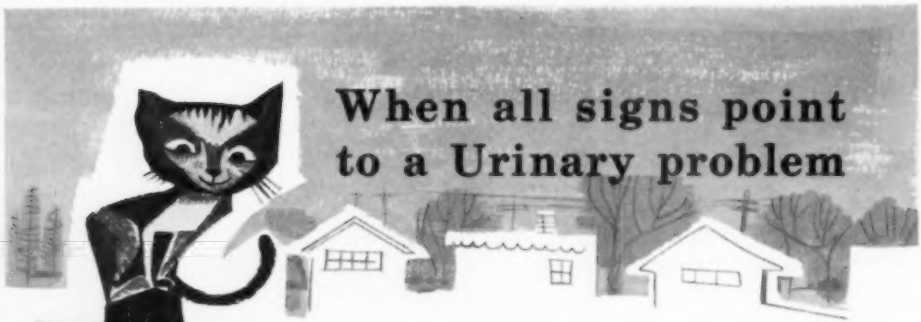

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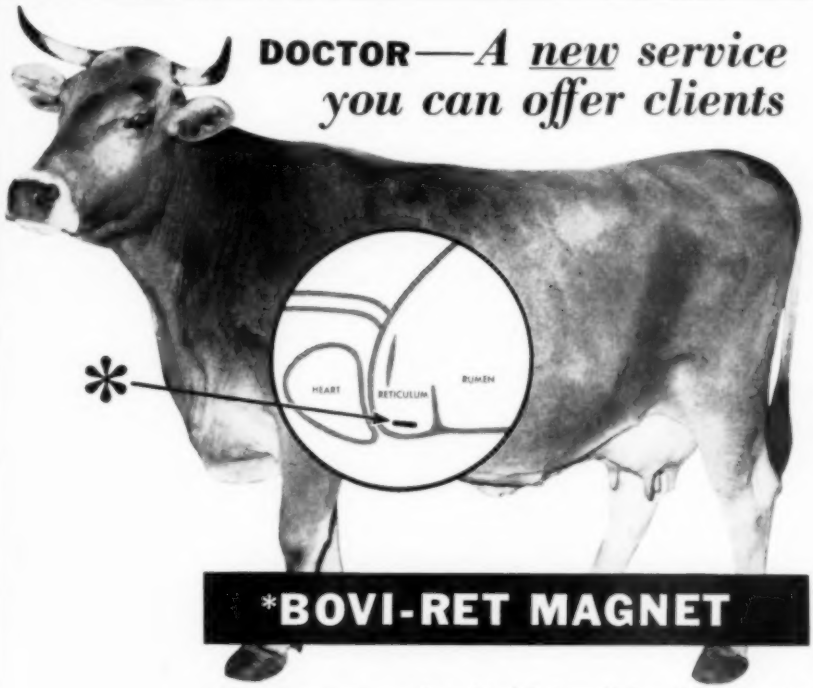

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News From Washington

Legislation of special interest to the veterinary profession in the second session of the 84th Congress, that became law when signed by President Eisenhower, included: **The U.S.D.A. appropriations** (fiscal year 1957, PL 554) provided $49,972,000 for all research in ARS; $26,294,000 for plant and animal disease and pest control; $15,650,000 for meat inspection; and $3,500,000 for research at Plum Island. Supplemental appropriations for the U.S.D.A. (PL 814) included $16,250,000 for construction of the Animal Disease Laboratory, to be located at Ames, Iowa; funds (PL 465) for the brucellosis eradication program through fiscal year 1958 (see JOURNAL, April 15, 1956: adv. p. 12).

* * * *

Among the beneficiaries of the Federal Executive Pay Act (PL 854) are: the administrator of ARS and the three deputy administrators; also, the salary limitation on technical experts or scientists for research and study of foot-and-mouth disease is now $19,000 (formerly $15,000). Public Law 799, approved July 25, 1956, amended the Act, approved Feb. 1, 1907, to regulate the practice of veterinary medicine in the District of Columbia.

* * * *

Among other provisions of PL 911, 84th Congress, is one inaugurating **federal traineeships in public health,** for physicians, dentists, **veterinarians,** sanitary engineers, and other qualified personnel. Stipends vary, being $4,800 for postdoctoral candidates. Applications and information may be obtained from Public Health Service regional offices or by mail from Public Health Service, Bureau of State Services, Department of Health, Education, and Welfare, Washington 25, D.C.

* * * *

The U.S.D.A. reported **vesicular exanthema was diagnosed** on August 14 in a herd involving some 1,300 hogs at Secaucus, N.J. Prompt eradication measures, including slaughter and clean-up, were taken by state and federal officials, your reporter was informed; it is believed the outbreak has been brought under control. This is the first new appearance of vesicular exanthema in the United States since November, 1955.

* * * *

Representation of the sheep industry, state veterinary livestock officials, research workers, and others attended a meeting arranged by the director, Livestock Regulatory Programs, ARS, in St. Louis, Mo., August 17, to discuss problems relating to the **eradication of scrapie.** It is reported there was general agreement among the conferees that an effort should be made toward complete eradication of the disease. One recommendation adopted was that the Secretary of Agriculture establish a national advisory committee on scrapie, with members representing industry, research, and regulatory officials. Another was that a national or international research program on scrapie be inaugurated as soon as practicable.

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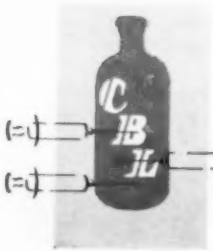

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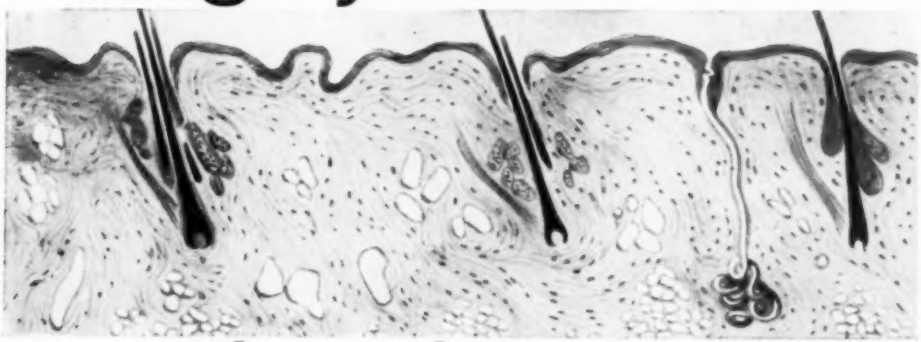

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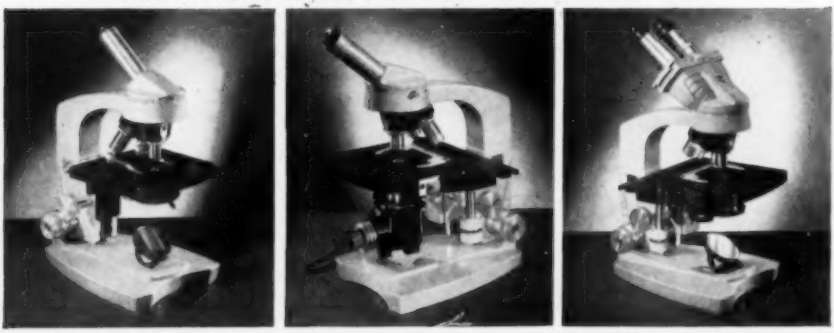

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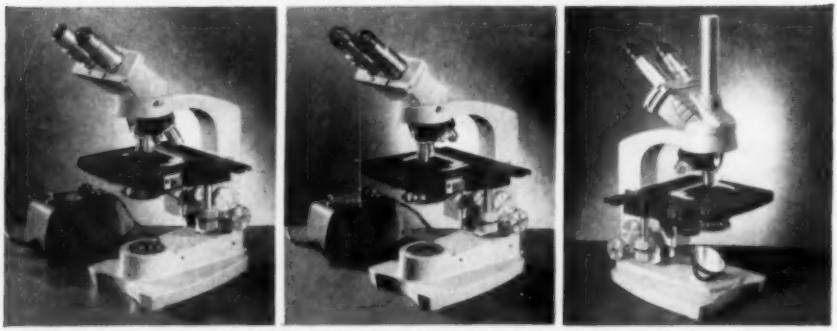

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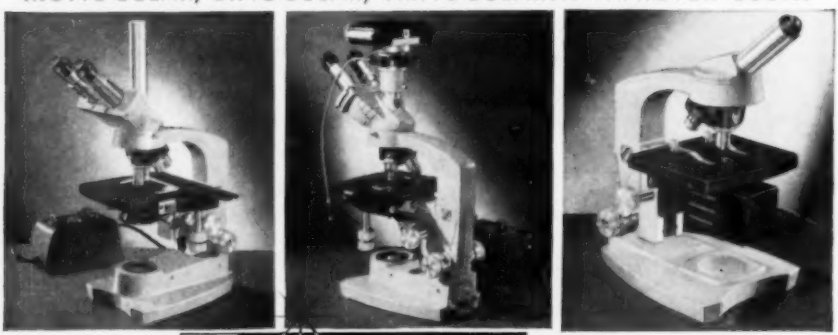

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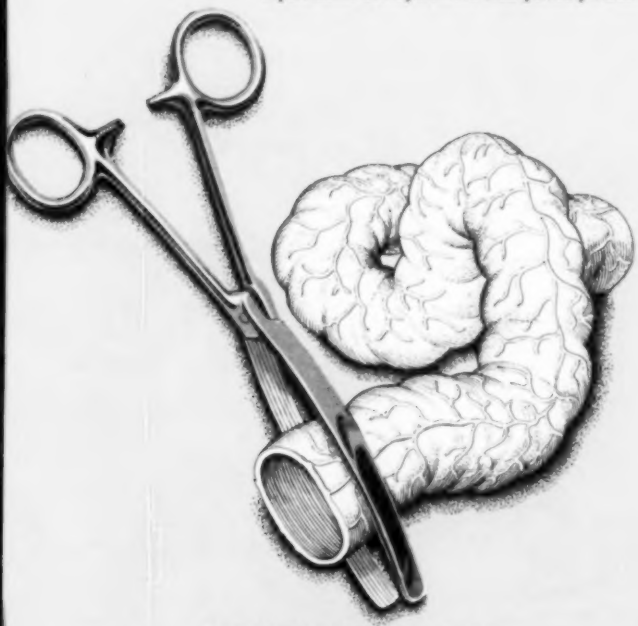

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1. Koger, R. B.: Vet. Med. *50*:713, 1955.
2. Chambers, E. E.: North Am. Veterinarian *37*:105, 1956.
3. Shaw, J. C.; Gessert, R. A., and Chung, A. C.: North Am. Veterinarian *36*:918, 1955.
4. Morris, R. C., and Hall, C. E.: J.A.V.M.A. *128*:132, 1956.

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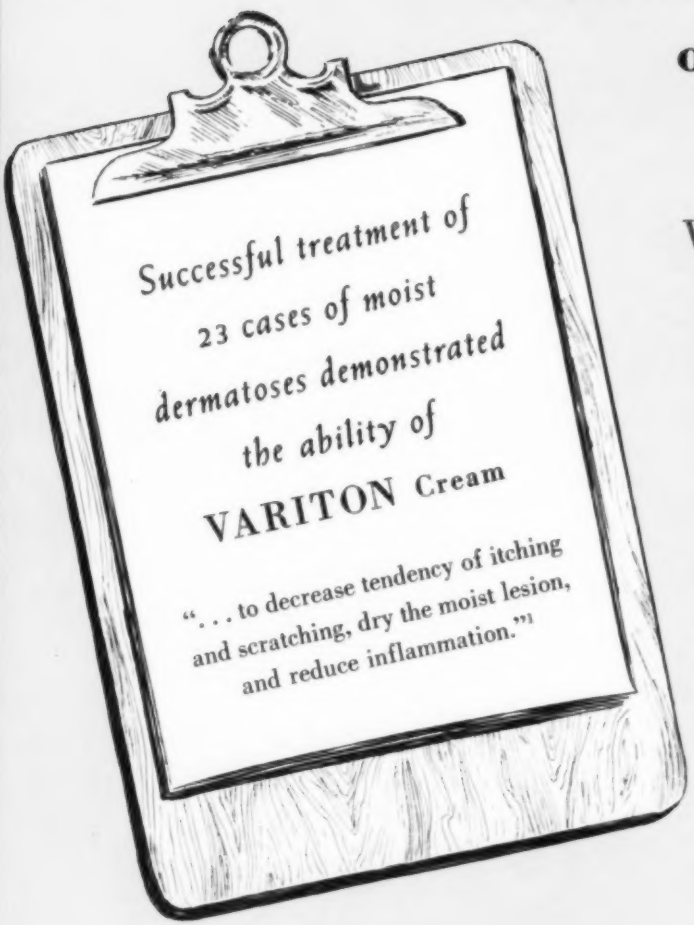
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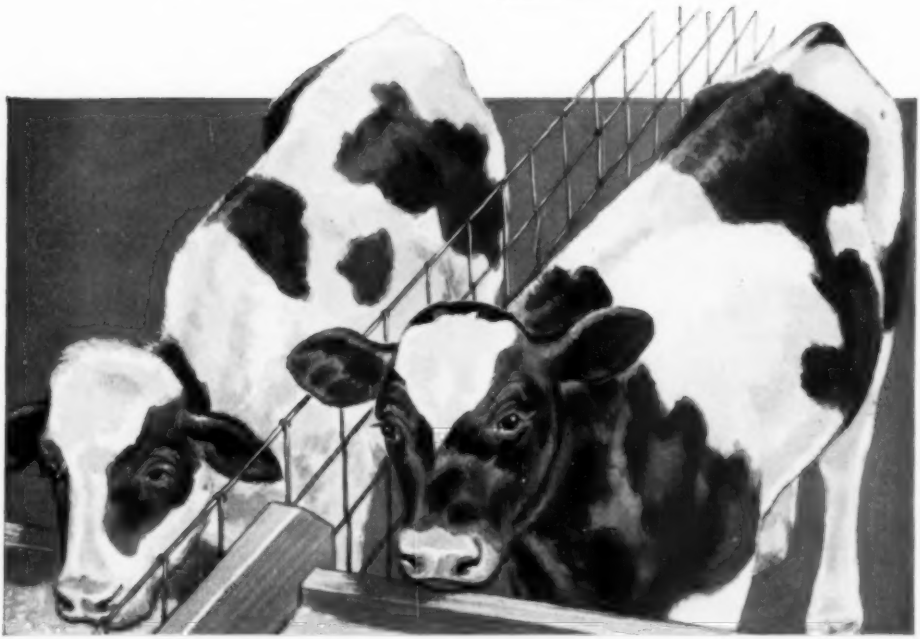

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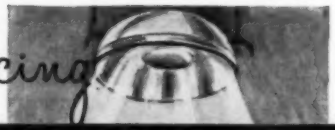

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We present below abstracts of a few typical case reports pertaining to the use of *Mikedimide*:

Morphine sulfate (0.5 gr.) was administered subcutaneously and 3 cc. (180 mg.) of pento barbital sodium was given intravenously to a deep surgical plane. The subject suddenly ceased breathing. The heart was weak and reflexes were absent. Two and one-half minutes after respiratory arrest, 105 mg. of *Mikedimide* was given slowly intravenously. The amplitude of respiratory movements markedly increased. Reflexes returned within one and one-half minutes. The operation and recovery were uneventful. The sleeping time was shortened about two hours.

The patient was in shock and appeared to be a poor surgical risk. A single injection (45 mg.) of pentothal sodium was administered intravenously. Respiration ceased before the injection was completed. The heart was weak and all reflexes were absent. Within 30 seconds after respiratory arrest, 1 cc. (30 mg.) of *Mikedimide* was given intravenously. Respiration was resumed within 15 seconds. The heart became strong and the palpebral reflex returned in one and one-half minutes. Recovery was uneventful.

The patient was anesthetized with surital sodium (480 mg.), given intravenously. Reflexes were absent, respiration was slightly depressed and the heart was strong. Six minutes after anesthesia, *Mikedimide* (120 mg.) was injected slowly intravenously. There was an immediate respiratory response. The palpebral reflex returned at once. At the end of the *Mikedimide* injection, the dog tried to lift his head and sniffed the operating table. Fourteen minutes after the *Mikedimide* injection, the dog was almost conscious. The sleeping time was shortened by 50 percent and recovery was uneventful.

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Mikedimide (Methetharimide), a New Barbiturate Antagonist

Preliminary Report

Edward Baker, V.M.D.
Englewood, N. J.

The barbiturates represent some of the most commonly used drugs in the practice of veterinary medicine, especially in small-animal medicine. They are an extremely valuable group of drugs, primarily because of their ability to rapidly produce a desired plane of anesthesia for the surgical and other procedures calling for the employment of an anesthetic.

Proper selection and rational use of the barbiturates rest upon an intimate knowledge of their pharmacology and toxicology as well as an acquaintance with the important variations in action and toxicity manifested by certain individual members. The major variations occur in the duration of the depressant action, the location of the destruction site in the body, and the suitability for special therapeutic purposes.

Inasmuch as larger doses of barbiturates are used to produce the anesthetic effect rather than the hypnotic effect, the clinician observes a progressive increase in respiratory depression, with rate, depth and minute volume all being affected. Although doses for the different barbiturates have been worked out properly, it is obvious from experience that the administration of the barbiturate becomes an individual problem with each animal. It is not uncommon to see cases of shock and respiratory arrest occurring in animals in which the calculated dose has not been fully employed. Thus, there still remains a responsibility of assessment on the part of the clinician to determine when a safe plane of anesthesia has been reached. Inasmuch as effective anesthetic dosage is calculated from a mean average, the possibilities of "response" variations in animals always must be considered.

A further complicating factor in administering an effective dose of a barbiturate anesthetic is the employment of preanesthetic sedatives such as morphine. These produce a variable degree of respiratory depression which is additive to the depression of respiration accompanying the barbiturate. The preanesthetic sedative may contribute relatively in further narrowing the margin of safety of the anesthetic.

The anticipated sleeping time, with different barbiturates, varies with their grouping into various classes, such as ultra-short, short and prolonged action, and no doubt each group manifests its own special problems.

There has been a long need for a highly selective, effective and prompt-acting barbiturate antagonist which could be used safely and routinely and particularly in emergency states to reverse the barbiturate action. Such a need seems to have been fulfilled with the advent of Mikedimide, a drug which exerts its antagonism on almost all types of barbiturates and, from our experience, has furnished prompt activity to increase respiration, restore reflexes and shorten sleeping time.

Mikedimide (methetharimide) chemically is 3,3-methylethyl glutarimide. It is related to the barbiturates by the similarity of the ring system.

The antagonism or reversal of barbiturate anesthesia by Mikedimide appears to be directly proportionate to the effective plane of anesthesia induced by the barbiturate employed. The level of barbiturate antagonism by Mikedimide is also "to effect" and the changes produced are demonstrated notably in reflex return, respiration rate, pulse rate, heart sounds, and increase in blood pressure.

Overdosage of Mikedimide can induce mild convulsion, particularly when it is given too rapidly. A small dose of the bar-

biturate through the same needle readily reverses this effect. In practice, however, convulsions rarely have been seen to last longer than 30 to 60 seconds and no barbiturate has ever had to be employed. In laboratory animals, including dogs and cats, this effect has been demonstrated at will and the specificity of antagonism of these drugs for one another has been seen clearly.

Mikedimide has been administered through various routes, *i.e.*, intravenous, intraperitoneal, intramuscular, intrathoracic and subcutaneous, with the same visible antagonism to barbiturates observed. There is some indication that Mikedimide is excreted in the urine rapidly and unchanged.

We have examined the use of this drug in almost 200 cases, employing cats and dogs. We can report good or excellent results in about nine out of ten cases. In some of the cases where a poor result was indicated, the classification for this result was based usually on the fact that there was no pronounced shortening of sleeping time, although excellent reflex return and respiration response were noted. Experience with cats has been particularly gratifying and results have been uniformly satisfactory.

Dosage

The dosage of Mikedimide that we have used in emergencies is as follows:

Dogs: 1 to 2 cc. (30 to 60 mg.) or more per 5 pounds of body weight until the effect desired was reached. Mikedimide was given slowly intravenously over five minutes. It was rarely necessary to exceed 60 mg. per five pounds of body weight, even in cases of extreme barbiturate depression.

Cats: 1 to 2 cc. (30 to 60 mg.) per average cat (approximately 8 lb.) was given slowly intravenously over five minutes. If the vein is impenetrable, other routes may be used.

The dosage for routine use postoperatively is as follows:

Dogs: 1 cc. (30 mg.) per 5 pounds of body weight. If the effective plane was not reached, another injection of 0.5 cc. (15 mg.) per 5 pounds of body weight was given until the desired effect was obtained. This was given slowly intravenously over five minutes.

Cats: On cats of average size (approximately 8 lb.), 1 cc. (30 mg.) was injected intraperitoneally until the desired effect was reached.

When Mikedimide was used intramuscularly, intraperitoneally or subcutaneously, the response time was slower. It is important to understand that effective antagonism does not mean that the animal will jump off the table and walk back to his cage. An effective response to the antagonist means an increase in the rate and depth of respiration, the return of anterior and posterior digital and palpebral reflexes, and improvement in the color of the visible mucous membranes.

The evidence seems to point to a level of dosage which should be fixed to the amount of anesthetic employed and the plane of anesthesia reached. It appears that Mikedimide will antagonize approximately, milligram for milligram, the corresponding dose of the barbiturate used for anesthesia in routine postoperative treatment.

The effect of the dosage of Mikedimide must be individualized by the clinician corresponding to the slow administration of Mikedimide and observing, at the same time, the return of reflexes and changes of respiration, pulse and heart. The safe plane at which Mikedimide should be terminated is again one which is "to effect" as decided by the clinician.

We have seen that Mikedimide can bring the animal completely out of the anesthetic plane into total consciousness, particularly when a light anesthetic dose of the barbiturate has been administered. It appears advisable to produce only a semiconscious response which will show return of the reflexes, and an increase of the depressed respiration.

Case Reports

We present a few typical cases pertaining to the use of Mikedimide:

Case 1: Nonpregnant bitch, eight years old, weighing 30 pounds. Pyometra, anorexia, vomiting, and polydipsia for several days were noted. The patient was in reasonably good condition but slightly dehydrated. Morphine sulfate (0.5 gr.) was

administered subcutaneously and 3 cc. (180 mg.) of pentobarbital sodium was given intravenously to a deep surgical plane. Although the anesthetic was administered slowly, the subject suddenly ceased breathing. The heart was weak and reflexes were absent. Resuscitation with oxygen insufflation by endotracheal tube restored breathing and color to normal for two minutes. Two and one-half minutes after respiratory arrest, 105 mg. of Mikedimide was given slowly intravenously. The amplitude of respiratory movements markedly increased. Reflexes returned within one and one-half minutes. After the reflexes returned, the patient was scrubbed for surgery and anesthetized again, with Demerol administered intramuscularly. The operation and recovery were uneventful. The sleeping time was shortened about two hours.

Case 2: Male cat, two years old, weighing 9 pounds, apparently hit by a car. The cat was semiconscious, the lower jaw was broken and the lower lip split. There was heavy salivation. The patient was in shock and appeared to be a poor surgical risk. A single injection (45 mg.) of pentothal sodium was administered intravenously. Respiration ceased before the injection was completed. The heart was weak and all reflexes were absent. Within 30 seconds after respiratory arrest, 1 cc. (30 mg.) of Mikedimide was given intravenously. Respiration was resumed within 15 seconds. The heart became strong and the palpebral reflex returned in one and one-half minutes. The animal remained under anesthesia long enough for us to wire the jaw and suture the lip. Recovery was uneventful.

Case 3: Pregnant bitch, five years old, weighing 12 pounds, presented for celiohysterectomy. X-ray showed five fetuses, two very large. The patient was showing some toxemia and fatigue from nonproductive labor. She was apparently in good health except for her parturient condition. Pentobarbital sodium (180 mg.) was administered intravenously over three minutes. The posterior digital and palpebral reflexes were gone after the first minute of the injection, and the respirations were ten per minute. Thirty minutes after anesthesia, Mikedimide (45 mg.) was administered intravenously with a notable increase in the respirations to 21 per minute and with visible increase in depth. The heart was very strong and reflexes returned within one minute. The only side-effect noted was retching and some vomition. The pups were delivered cyanotic, with no respiration, and faint and thready pulse. Each pup was given 7.5 to 10 mg. of Mikedimide intrathoracically within ten minutes after delivery and all started breathing and were crying in five minutes or less. The recovery of the mother was uneventful.

Case 4: Canine, male, two years old, weighing 55 pounds, presented for the removal of a pin embedded in one cheek. The patient was anesthetized with surital sodium (480 mg.), given intravenously. Reflexes were absent, respiration was slightly depressed and the heart was strong. Six minutes after anesthesia, Mikedimide (120 mg.) was injected slowly intravenously. There was an immediate respiratory response and some involuntary twitching was present. The palpebral reflex returned at once. At the end of the Mikedimide injection, the dog tried to lift his head and sniffed the operating table. Fourteen minutes after the Mikedimide injection, the dog was almost conscious. The sleeping time was shortened by 50 percent and recovery was uneventful.

Case 5: Nonpregnant bitch, three years old, weighing 50 pounds, hospitalized for instrumentation and examination for severe vaginitis and vulvitis. The response to pentobarbital sodium was very erratic and after 440 mg. had been given, the respirations ranged from deep to shallow and from eight to three per minute. Mikedimide (30 mg.) was given intraperitoneally. There was no response during the first two minutes. Since the respirations of the animal seemed to become progressively more depressed, Mikedimide (90 mg.) was administered intravenously within one minute. The respirations became deeper and more rapid. The tongue had ranged from cyanotic to pink and after a second injection of Mikedimide, it became pink and remained so. Two hours after Mikedimide, the animal was lifting its head and attempting to stand. No side-effects were observed. The patient was discharged.

Case 6: Nonpregnant bitch, six months old, weighing 18 pounds, presented for routine hysterectomy. The patient was anesthetized with pentobarbital sodium (180 mg.) intravenously. The heart was strong, the reflexes were absent, and respiration was depressed. In order to bring the subject to a safer plane for surgery, Mikedimide (30 mg.) was given intravenously and respiration was stimulated immediately to a point where the surgery could be safely performed. One hour after the anesthetic, the patient was given a second injection of 180 mg. of Mikedimide. The reflexes returned within two minutes and the heart was strong. There was increased depth of respiration with partial return of jaw resistance. Within four hours after surgery, the patient was attempting to stand. No side-effects were seen and recovery was uneventful.

Conclusions and Recommendations

From our experience in this preliminary study, we feel that Mikedimide is a most important drug in the control of routine barbiturate anesthesia and particularly in barbiturate overdosage or sudden respiratory arrest. It appears to possess a specific respiratory stimulation effect only in the presence of barbiturates and, routinely, it suggests valuable use to terminate anesthesia, shorten the sleeping time, restore reflex activity and minimize the need for prolonged medical attention. The drug appears to be a specific barbiturate antagonist on almost a milligram-for-milligram basis.

In the initial trials with Mikedimide, two drawbacks occasionally were found to the routine use of this product—transient convulsions and a tendency to regression to a pre-Mikedimide anesthetic plane. Further work shows that these effects are due to improper use of the drug. During a routine experimental procedure, requiring intravenous injection over a prolonged period, it was noted that neither convulsions nor regression occurred. When this observation was applied to routine clinical cases, no regression or convulsions were noted. The following recommendations are therefore submitted:

1. Use Mikedimide routinely in all cases requiring barbiturate anesthesia.
2. Inject it slowly over a period of about five minutes.
3. Give until the desired effect is reached. Do not expect the patient to walk off the table.
4. The drug may be administered by any route. Intramuscular injection appears to be a desirable route for routine, nonemergency administration.

Mikedimide is an important addition to the armamentarium of the veterinarian and should prove to be extremely useful in eliminating some of the problems of barbiturate anesthesia.

Further studies are in progress and will be reported on at a later date. These will include greater elaboration on the mode of action of this drug and also experience with its use in large animals.

Acknowledgment

The author expresses his thanks to Parlam Corporation, 340 Canal Street, New York, N. Y., manufacturers of Mikedimide, who so generously supplied the drug for the study reported here.

The preceding three pages and this page are a reprint of an article which appeared in *The North American Veterinarian* (March, 1956: 219-222.)

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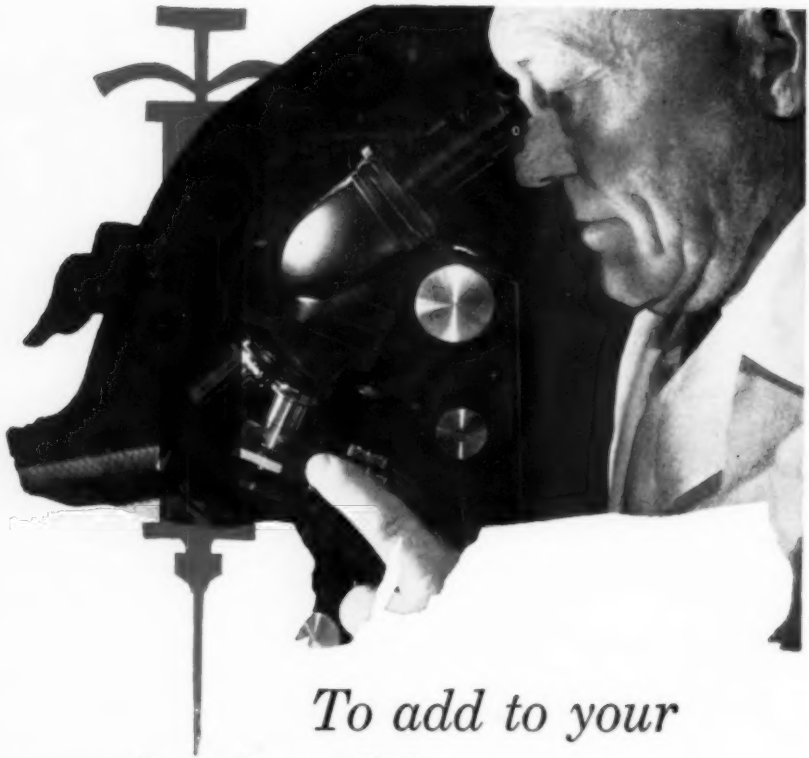

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The Epizootiology of Bovine Leptospirosis in Washington

HERBERT G. STOENNER, D.V.M.; FRANK W. CREWS, Ph.D.; A. E. CROUSE, D.V.M.; LESLIE E. TASCHNER, B.S.; CHARLES E. JOHNSON, B.S.; JOSEPH WOHLEB, Jr., B.A.

Hamilton, Montana, and Olympia, Washington

THE WIDESPREAD DISTRIBUTION of bovine leptospirosis in the United States was recently emphasized in a review by Reinhard.[1] In spite of the prevalence of leptospirosis, only meager knowledge of the natural epizootiology of this disease is available.[2,3] Whether only domestic livestock are involved in the chain of infection or whether wild animals and birds also may be responsible for interherd dissemination of infection is not known. Through experimental studies,[4-6] it has been determined that most domestic animals are susceptible to infection with *Leptospira pomona* but some are potentially more capable of disseminating the disease. For example, recovered swine shed leptospiras in their urine for longer periods and in greater numbers than do recovered cattle.[6] Hence, in agricultural areas where swine and cattle are raised on the same premises, swine probably play a more dominant role in the epizootiology of leptospirosis.

This report deals principally with epizootiological studies conducted in a state in which the raising of beef and dairy cattle is the predominant type of animal industry. Pertinent observations on the symptomatology, morbidity, and mortality associated with the disease will also be described.

From the U.S. Department of Health, Education and Welfare, Public Health Service, Communicable Disease Center, Atlanta, Ga., and National Institutes of Health, National Institute of Allergy and Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Mont. (Stoenner); and Washington State Department of Agriculture, Division of Dairy and Livestock, Olympia (Crews, Crouse, Taschner, Johnson, and Wohleb).

The cooperation of practicing and regulatory veterinarians; the U.S. Department of Agriculture, Animal Disease Eradication Branch; and the College of Veterinary Medicine, State College of Washington, Pullman, is gratefully acknowledged by the authors.

MATERIALS AND METHODS

In April, 1953, laboratory facilities for leptospiral serology became generally available to veterinarians in the State of Washington. Studies described in this report began at that time and were concluded in July, 1954. Serums examined for antibodies against leptospiras originated from herds in which abortions or unusual losses occurred, from herds subjected to a routine test for brucellosis, and from cattle prior to sale or exhibition at state or county fairs. Most of the serums were first tested for brucellosis in the laboratory of the U.S. Department of Agriculture in Puyallup, Wash., and then forwarded to the laboratory of the Division of Dairy and Livestock in Olympia, Wash., for tests for leptospirosis.

After erythrocytes had settled during overnight refrigeration, serums were tested by the combination plate and capillary-tube test.[7-9] Since this test permitted the examination of large numbers of serums, and since it compared favorably with the agglutination-lysis test in specificity and sensitivity, it was used for this study. Routinely, only antigens prepared from *L. pomona*, Johnson strain, were employed. Limited attempts were made to detect antibodies against other serotypes. When a significant number of serums from a herd agglutinated *L. pomona* plate antigen in low dilutions of serum only, agglutination-lysis tests with *L. pomona, Leptospira canicola, Leptospira icterohaemorrhagiae, Leptospira hebdomadis,* and *Leptospira grippotyphosa* were also performed to determine whether reactions with *L. pomona* plate antigen reflected cross reactions with antibodies stimulated by other serotypes. During the later part of the study, 10 per cent of the serums from herds tested were examined also with *L. hebdomadis* plate antigen.

Herds which contained cattle with serum titers of 1:160 or greater (reactors) were classed as infected herds. Frequently, most of the serologically positive animals in recently infected herds possessed serum titers of 1:640 or greater. In infected herds, animals with serum titers of 1:40 (suspects) were considered to possess a low titer against *L. pomona*, as such reactions more likely reflected

true antibody than nonspecific properties occasionally encountered in bovine serums. Because infected herds were affected by regulatory measures, positive serums from herds which contained only a few reactors were tested also by either the rapid-plate[8] or agglutination-lysis methods.[10] Only serums which reacted at significant titers on the latter tests were considered positive. Herds were classed as free of leptospirosis if all serums were negative or if none possessed a titer exceeding 1:40 on the capillary-tube test.

Epizootiological investigations were conducted to elucidate the means of interherd dissemination and the factors which may affect the spread of leptospirosis within a herd. Because of limited personnel, investigation of recently infected herds was emphasized. These herds were selected because owners more accurately recall recent occurrences, such as changes in management and the addition of replacements. Since it was often impossible to visit each ranch at the time the disease was diagnosed, some herds were studied several months after the epizootic had occurred.

Weanling guinea pigs were used to recover leptospiras from urine of cattle, chiefly from herds serologically positive against serotypes other than *L. pomona*. More extensive attempts to isolate leptospiras from *L. pomona*-infected cattle and their environments were conducted by the staff of the College of Veterinary Medicine, State College of Washington, Pullman. Their studies have been reported[11-13] or will be presented in other publications.

RESULTS

Etiology.—Most of the bovine leptospirosis was attributed to *L. pomona* which was recovered from urine specimens from two of four herds studied. Antibodies against *L. hebdomadis* were occasionally encountered in serums from herds which were infected with *L. pomona*, but attempts to isolate leptospiras from such serologically positive cattle failed. If *L. hebdomadis* were actually present among cattle in Washington, one would expect to find herds which were serologically positive chiefly against *L. hebdomadis*, and this was not the case. Since these antibodies were always associated with herds infected with *L. pomona*, it is likely that they represent paraspecific reactions against *L. pomona*.

In tests of most of the negative herds, some involving more than 300 animals, all of the serums were entirely negative or only occasional specimens agglutinated *L. pomona* antigen in a 1:10 serum dilution. However, a significant number of serums from some herds reacted at low dilutions on the capillary-tube test. These reactions may reflect residual antibody from previous experience with *L. pomona*, cross reactions with other serotypes, or nonspecific properties. The results of agglutination-lysis tests performed on 66 of these serums selected from 15 representative herds are summarized (table 1). Many serums possessed some activity against *L. pomona* at low dilutions but most of them reacted more against *L. canicola* and *L. icterohaemorrhagiae*, some at titers ordinarily considered significant of infection with the respective serotype. Most of these reactions were believed attributable to peculiar nonspecific anti-leptospiral properties for the following reasons:

1) If these herds were actually infected with leptospiras, some serums should possess high titers and a higher percentage of herd involvement should be found, such as is the rule in herds infected with *L. pomona*.

2) Repeated attempts to demonstrate leptospiras by dark field examination and animal inoculation of urine from some animals in these herds were entirely negative.

3) Although some serums possessed titers of 1:160 on the capillary-tube test, most did not react at titers greater than 1:10 on the rapid-plate test. The titers of bovine serums possessing homologous antibody against the serotype incorporated in the antigen usually are the same by both techniques.

4) In more recent studies,[14] most of such serums failed to react on either the plate or capillary-tube test if the pH of the antigen was increased from 7.3 to 7.6. This change did not materially affect the titers of weakly positive serums containing specific antibody against the serotypes in the antigen.

5) Clinical histories of herds from which these serums originated were not suggestive of leptospirosis.

Prevalence of Bovine Leptospirosis.—The prevalence of the disease is reflected in serological tests performed during the year ending March, 1954 (table 2). During the summer of 1953, repeated attempts were made to control the spread of the disease through serological testing and segregation. Therefore, the number of serums examined (51,361) greatly exceeds the number of cattle tested. In most of the infected herds, the number of serologically positive animals increased with each successive test; however, the number of serologically positive animals shown (table 1) is based on the initial entire herd test.

TABLE I—Results of Agglutination-Lysis Tests Conducted on 66 Bovine Serums* that Possessed Peculiar Anti-Leptospiral Properties

Leptospira serotype	No. of serums reacting at indicated titers				
	Neg.	1:10	1:100	1:500	1:5,000
L. pomona	23	40	2	1	—
L. icterohaemorrhagiae	9	39	16	2	—
L. canicola	8	34	19	4	1
L. grippotyphosa	46	20	—	—	—
L. hebdomadis	59	7	—	—	—

*With the capillary-tube test, 54 serums reacted with L. pomona antigen at a 1:10 dilution of serum, and 12 at 1:160.

Approximately 6 per cent of the herds contained cattle which had experienced leptospirosis. The division of positive herds into two categories is somewhat arbitrary and it is based on epizootic history, distribution of serum titers, and incidence of reactors among various age groups in a herd. If it had been possible to investigate every epizootic, probably more would have been classed as herds with residual evidence of past infection. At the time of the initial entire herd test, 38 per cent of cattle in recently infected lots were serologically positive compared to 14 per cent in herds with residual evidence of past infection. In recently infected lots, the ratio of reactor to suspect was almost 2 to 1 while, in the other category, the ratio was reversed. Some cattle which have had leptospirosis apparently retain antibodies indefinitely, whereas others gradually become serologically negative. When the number of suspects equalled or exceeded the reactors on an entire herd test, it indicated that the epizootic had become self-limiting and that only residual antibody from previous infection remained. Epizootiological investigations of some of these herds confirmed this premise.

Because of the method of sampling, the incidence shown (table 2) may not reflect the true prevalence of the disease. The effect of sampling is evident in a comparison between tests of samples from the northwestern and those from the southeastern portion of the state. For example, in Pierce and King counties (fig. 1), during a routine test for brucellosis, 18 of 405 herds contained serologically positive cattle. Of the 18, 12 were classed as herds which had experienced infection several years previously. In contrast, many samples from Columbia and Walla Walla counties were taken from diseased cattle. Of 123 herds, 29 contained positive animals and 23 of these herds had been recently infected. Since many of the samples were taken from brucellosis-free herds in which varying numbers of unexplained abortions had occurred, the actual prevalence of the disease is probably lower than the data in table 2 indicate.

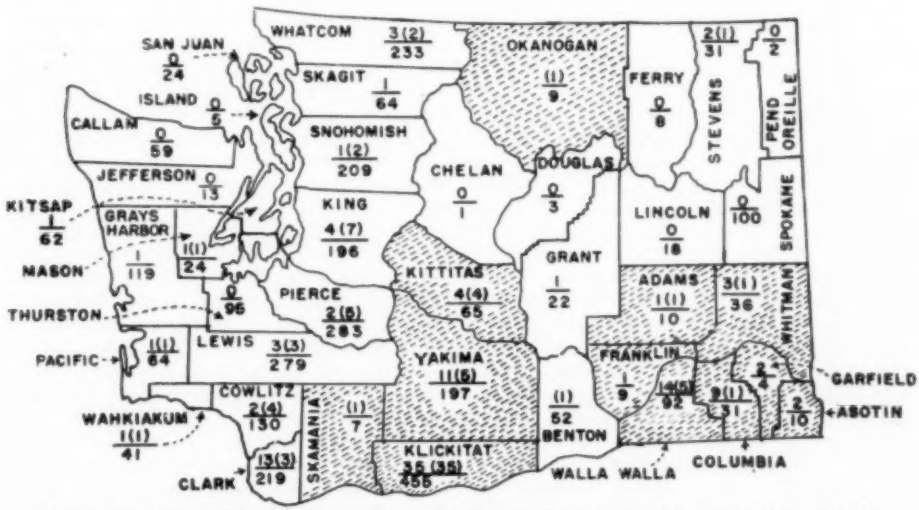

Fig. 1—Prevalence of bovine leptospirosis in Washington. Denominator indicates number of herds tested. Exposed numerals in the numerator denote number of herds which had recently experienced infection, whereas those enclosed in parentheses represent herds which retained only residual antibodies from infection probably experienced several years earlier. In shaded counties, more than 10 per cent of the herds tested contained serologically positive cattle.

TABLE 2—Prevalence of Antibodies Against Leptospira Pomona Among 34,718 Cattle in Washington Whose Serums Were Tested by the Combination Plate and Capillary-Tube Test

Classification of herd	No. of herds	No. of cattle			Total tested
		Neg.	Suspect	Reactor	
Free of leptospirosis:*					
Entire herd tests	660	17,609	0	0	17,609
Partial herd tests	2,461	4,227	0	0	4,227
Infected herds:					
Recently infected herds	117	5,588	1,181	2,295	9,063
Herds with evidence of past infection	86	3,279	370	169	3,819
Total	3,324	30,703	1,551	2,464	34,718

*Herds were classed as free of leptospirosis if all animals were negative or if none possessed a capillary-tube titer exceeding 1:40.

Suspect = serum titer of 1:40; reactor = serum titer of 1:160 or greater.

Geographic differences in prevalence of leptospirosis among cattle in the state are presented (fig. 1). Unfortunately, some counties were not sufficiently sampled so that an accurate index of infection could be determined. Local interest of the veterinary profession and the cattlemen materially affected the number of samples received; the greatest percentage of herds was sampled in Klickitat County where the disease was first recognized. Usually, the diagnosis of leptospirosis stimulated the submission of blood samples from other herds in the area. Leptospirosis was most prevalent in the southeastern quarter of the state. This distribution was substantiated by a low percentage of reactors among cattle sold through community sales west of the Cascade Range, whereas many cattle sold through yards in the south-central and southeastern portion of the state possessed antibodies at a titer sufficiently high to indicate recent infection. Of the cattle sold through a yard in Yakima County, 12 per cent reacted at titers of 1:160 or greater; of 1,934 cattle sold in various sections of the state, 5 per cent reacted at a titer of 1:160 or greater.

Epizootiology.—Epizootics of leptospirosis occurred among cattle maintained in varied environments. The disease was even diagnosed in herds of beef cattle which were grazing on large areas of semiarid rangeland. In these situations, ponds, potholes, or slow running streams used as sources of water, provided the means of dissemination. During winter months, the disease often spread rapidly among cattle closely confined in muddy feedlots, even though husbandry methods used precluded contamination of food and water with infectious urine. Presumably, the disease was spread through dermal contact with moist contaminated soil, since it spread slowly through a herd similarly fed and watered but confined in a dry, sandy, well-drained feedlot. Grazing on irrigated pastures, the use of natural streams as a source of water, and close confinement in muddy corrals were factors frequently associated with rapidly spreading epizootics.

The disease was diagnosed more frequently in herds of beef than of dairy cattle. Beef cattle were predominant in all counties where leptospirosis was prevalent. Of 64 herds investigated, 50 were beef and 14 were dairy cattle. However, the method of sampling precluded an analysis of test results that would accurately reflect the relative prevalence among beef and dairy cattle.

Because leptospiras do not readily withstand freezing, leptospirosis is generally considered to be a tropical disease which can spread only during warmer seasons. On the contrary, most epizootics in Washington were recognized during late fall and winter. Factors which may have affected this apparent seasonal occurrence include: (1) closer confinement and observation of beef cattle during the winter supplemental feeding period; (2) during late fall and winter, brood cows are in their last trimester of gestation when abortions from this disease are more likely to occur; and (3) unless heavy losses occurred, the disease could escape notice, especially among nonpregnant cows widely scattered on summer ranges.

Leptospirosis was usually a self-limiting herd problem. The time necessary for the disease to become self-limiting was dependent upon the size of the herd, environmental conditions affecting the spread of leptospirosis, and the number of susceptible replacements or calves born into the herd. Under environmental conditions favorable to the survival and dissemination of *L. pomona*, most of the animals frequently became infected within three to six months. Investigations of commercial beef herds, in which abortions attributable to leptospirosis had occurred two or more years previously, revealed that the disease usually became self-limiting within one year. However, in two herds of 240 and 800 breeding animals each, abortions and deaths, typical of leptospirosis, continued for two years.

The probable means by which *L. pomona*

was introduced into 64 herds were investigated (table 3). In some herds, the organism could have been introduced by several modes; therefore, all probable routes are listed in the table. In 27 herds, the disease apparently was contracted by contact with other herds during the summer grazing season; 12 had contact with known infected cattle, whereas 15 had contact with cattle which were not tested but which frequently had histories of losses and abortions typical of leptospirosis. In some instances, infection was introduced by the purchase of replacements prior to transfer of cattle to summer range; however, the original source of infection usually could not be explained so readily. Several herds are mixed on common ranges during the summer grazing season in many areas and poor fences often allow mixing of groups of range cattle. This interherd contact may have been responsible for a greater prevalence of leptospirosis among commercial herds of beef cattle than among dairy cattle.

On 22 occasions, the disease was probably introduced through the purchase of replacements. In many of these herds, losses from leptospirosis appeared four to six weeks after the addition of immigrant cattle. Some of these cattle were purchased at community sales. Upon inquiry about reactors found at these sales, owners sometimes disclosed that such animals were marketed because unexplained abortions had occurred in the herd or because these cattle were not making profitable gains.

In Washington, natural streams and irrigation canals which traverse many farms are frequently used as a source of water. Most natural waters in the state possess physical and chemical properties that support the viability of leptospiras. Of 11 epizootics, three occurred in herds located immediately downstream from known infected cattle. In Columbia County, the disease appeared in four closed breeding herds which utilized water from the same stream. The fact that the disease appeared later in herds upstream suggested that migrating wildlife may be involved in the epizootiology. Deer were prevalent in this watershed; however, no serological evidence of infection with *L. pomona* was found among 49 deer killed during the subsequent hunting season. Beaver were also prevalent, but unfortunately their possible role could not be investigated. The remaining four epizootics occurred in closed herds located on watersheds where the disease had also been recognized in other herds.

TABLE 3—Probable Sources of Bovine Leptospirosis in 64 Infected Herds

Probable mode of introduction into herd	No. of herds
1) Contact with other cattle while on summer range.	
A) Contact with known infected herds	12
B) Contact with untested herds, possibly infected	15
2) Recent purchase of herd replacements.	
A) History indicative and serology of replacements positive	15
B) History suggestive but serology of replacements not available	7
3) Water-borne from sources upstream.	
A) From known infected herds	3
B) From unknown sources	8
4) Contact with recently purchased swine	2
5) Contact with recently purchased horses	2
6) Exhibition at livestock shows	1
7) No plausible source	5

In five isolated closed herds, no plausible mode of introduction could be found. With the exception of one herd, all utilized natural streams as a source of water. With one exception, all herds were located in areas where deer and beaver were prevalent. One herd was located in an area frequented by thousands of ducks and geese.

Few swine are raised in Washington. Of 64 owners interviewed, 49 had never owned or did not own swine at the time their cattle were affected with leptospirosis. Of the remaining 15 owners, 12 raised only a few swine for local farm slaughter. With few exceptions, these were kept in pens separate from cattle. Appreciable numbers were raised and mixed with cattle on only three premises; recently purchased swine had been added to two of these premises prior to the onset of leptospirosis in cattle. Swine on one of these farms were serologically positive at the time cattle were tested.

On two occasions, cattle had contact with horses that had been purchased recently. In both cases, these horses possessed leptospiral antibodies at the time the cattle were tested. Whether or not these animals introduced the disease is problematical, since horses irregularly develop leptospiruria following the acute disease.[5,15] The geographic distribution of infected herds suggested that farm dogs were not involved in the epizootiology of this disease. With few exceptions, distance between infected herds greatly exceeded the range of the farm dog. Four dogs which were suspected of having carried the disease were serologically negative.

It is unlikely that blood-sucking arthro-

pods and insects are involved in the epizootiology of bovine leptospirosis. Epizootics frequently occurred during the winter months when insects were inactive and, in two, which occurred during summer months when blood-sucking flies were prevalent, groups of cattle separated by fences from the infected herds remained serologically negative.

Morbidity and Mortality.—Although the clinical features of the disease paralleled those previously described,[16] certain observations merit discussion. Leptospirosis in Washington was characterized by an extremely variable, inapparent infection rate but the causes for such variation were not apparent. Usually, herds were more severely affected in rapidly spreading epizootics. During the early phase of an epizootic, most infections were inapparent. Losses frequently appeared suddenly and occurred only during a portion of the epizootic. The state of nutrition did not materially influence the severity of the disease, since comparable numbers of abortions and deaths were observed among poorly nourished herds and among herds in excellent condition.

Abortion was one of the most frequently observed signs of leptospirosis. Usually, cows were serologically positive with high titers at the time of abortion. Retention of fetal membranes often followed abortions that occurred during the third trimester of gestation. Abortion rates observed in 58 epizootics involving animals of breeding age (table 4) were generally greater among herds in which seasonal breeding was practiced than among herds in which cows were bred during the entire year. Greatest losses occurred in herds of beef cattle which were infected when most of the females were in their last trimester of gestation. In ten herds, in which seasonal breeding was practiced, the number of abortions was negligible because some of the epizootics occurred during early summer when most of the cows were not pregnant. In one severely affected herd, conceptions did not occur while the epizootic was in progress. The next spring, after some of the cows had calved, parturitions ceased for approximately a month, after which the remainder of the herd calved normally. The interval between the epizootic and the break in calving coincided with the normal bovine gestation period.

TABLE 4—Frequency of Abortion Among Sexually Mature Females in 58 Herds of Cattle Infected with Leptospira Pomona

	No. of herds in which indicated percentage of mature females aborted					
Breeding practice	<5%	5 to 9%	10 to 19%	20 to 29%	30 to 39%	40% and>
Seasonal, for spring calving	10	4	8	11	2	6
Continuous	5	5	5	1	1	....

Mortality in herds affected by leptospirosis was variable and occurred among cattle of all ages. Some of the deaths among mature females resulted from metritis, secondary to retention of fetal membranes. Deaths probably attributable to leptospirosis were observed in 18 of 64 herds investigated. Usually, the mortality varied from 1 to 3 per cent but, in five herds, it was approximately 10 per cent. These losses were difficult to evaluate. Occasionally, adequate laboratory studies were not conducted to exclude other causes. Typical deaths from leptospirosis occurred suddenly, and cattle frequently were not observed to be ill for more than 24 hours.

Emaciation and unthriftiness were commonly reported by owners and, in many instances, accounted for a major portion of the financial loss. Generally, cattle under 1 year of age were more adversely affected than older animals. Weight loss was usually temporary (several months), but some calves were permanently stunted.

Discussion

This survey indicates that bovine leptospirosis is not as prevalent in Washington as it is reported to be in the midwestern and eastern United States. In Illinois,[17] 1,677 (11.2%) of 15,018 cattle tested were serologically positive against *L. pomona*. These serums originated from 1,528 herds, of which 418 (27.4%) contained positive cattle. In New York,[18] 138 (12.8%) of 1,074 cattle tested were serologically positive against *L. pomona*. These serums were obtained from 105 herds of which 36 (35.2%) contained animals which had experienced leptospirosis. Because different serological tools were employed and because criteria of infection varied in each survey, the prevalence of leptospirosis among cattle in these states can not be compared accurately.

In this survey, herds were considered to have had leptospirosis if 1 or more animals possessed capillary-tube titers of 1:160 or

greater. Animals with serum titers of 1:40 in such herds were also considered to be positive. This criterion accurately reflects the true prevalence of the disease. Bryan[17] classed Illinois herds as positive if any of the serums caused partial agglutination or lysis at a 1:10 dilution in the agglutination-lysis test, whereas York[18] considered New York herds to be positive if any of the animals possessed a complement-fixation titer of 1:4. Since titer end points were not determined in either survey, and since the distribution of titers among positive herds was not reported, it is impossible to calculate a herd incidence based on more realistic levels of antibody.

Although both authors state that a high percentage of animals in positive herds were involved, averages of less than 3 and 4 positive per infected herd were found in New York and Illinois, respectively. These low averages suggest that many of the infected herds contained only 1 or 2 positive animals, which is certainly not typical of herds infected with *L. pomona*. Possibly, in these two surveys, too much significance was placed on low titers which may have been nonspecific in nature.[5,14] If low titers were excluded, the herd incidence would probably have been much lower than these surveys indicate.

Because of the large number of blood specimens handled in this laboratory, it was impossible to test serums routinely against antigens other than *L. pomona*. In limited attempts to detect antibodies against other serotypes, serums of cattle from some positive herds were found to possess higher titers against *L. hebdomadis* than against *L. pomona*, but these reactions were presumed to be paraspecific in nature. In Florida,[19] a number of herds were found to be serologically positive chiefly against *Leptospira sejroe*, a member of the *hebdomadis* group, but an isolate from such a herd proved to be *L. pomona*. In more recent studies,[14] extensive cross reactions with *Leptospira autumnalis* were observed in serums of cattle from which *L. pomona* was isolated. In view of these irregularities in leptospiral serology, infection of cattle with serotypes other than *L. pomona*, which has been isolated repeatedly, can not be proved solely on a serological basis.

Some bovine serums apparently possess nonspecific anti-leptospiral properties which react in low titers on the agglutination-lysis test, chiefly against *L. canicola* and *L. icterohaemorrhagiae*. These serums also reacted at low titers with *L. pomona* antigens (pH 7.3) in the capillary-tube test but, in more recent studies, most of such serums did not react with plate antigens of pH 7.6. This increase in pH did not materially affect the titers of bovine serums containing low levels of homologous antibody against *L. pomona*. Hence, leptospiral plate antigens of pH 7.6 are more specific and their use is now recommended.

It is generally accepted that recovered cattle which are still shedding leptospiras are responsible for the intraherd dissemination of the organism. Although recovered "shedders" were responsible for the introduction of *L. pomona* into a significant number of herds investigated (34%), the means by which other epizootics were initiated could not be explained so readily. It could not be determined whether cattle were always responsible for introducing the disease on the range. Natural streams and irrigation systems appeared to affect the spread of leptospirosis but, again, whether cattle were solely responsible for contamination of the streams could not be ascertained. In one area, deer were suspected of being responsible but none of 49 deer killed in the area was serologically positive. Many epizootics have been reported[2] among herds located on particular streams. Also, a striped field mouse (*Apodemus agrarius*) has been reported[20] as the principal carrier of *L. pomona* in Denmark. It is apparent that further studies on the role of wildlife in the epizootiology of bovine leptospirosis should be made.

The epizootiology of bovine leptospirosis in other states in the Northwest would probably be quite similar to that observed in Washington. However, it is unlikely that the disease would have a comparable epizootiology in other sections of the country. Swine have an insignificant role, whereas in the Midwest they probably affect the dissemination of *L. pomona* considerably. Differences in climate, the composition of pH of soils, and natural waters would also affect the ecology of *L. pomona*.

At the present time, regulatory officials and research workers are generally confused about measures which should be applied to control bovine leptospirosis. Some contend that affected herds should not be quarantined because available serological tests do not indicate which positive animals

are still shedding leptospiras. Unfortunately, many who share this opinion are not aware of the problems encountered when no restrictions are placed on infected herds. On the contrary, some regulatory officials have hesitated to initiate a diagnostic service for leptospirosis because of anticipated complications in control operations. When a diagnostic test becomes generally available, it seems desirable to place some restrictions on the movement of cattle from infected herds until the disease has become self-limiting and recovered animals have ceased shedding. Otherwise, many owners of infected herds would promptly disperse their cattle through community sales or other trade channels in an attempt to minimize the financial loss.

Although further knowledge of the epizootiology is a prerequisite to eventual control of bovine leptospirosis, attempts should be made to prevent the spread of infection by "recovered shedders." Certainly, wherever possible, such animals should not have access to streams which may carry the organism to other herds.

Since a significant number of herds acquired infection from purchased replacements, some attention must be given to public and private sales. However, surveillance of cattle sold through community sales poses several problems. To test and identify reactors, as is done in the control of brucellosis, may not be practical since some cattle remain serologically positive long after they have ceased shedding organisms. These cattle would receive undue discrimination because their original value is usually restored after full recovery. However, it would be feasible to collect blood samples, test them at a central laboratory, and require the new owners to isolate replacements from the rest of their herd until test results were returned. If reactors had been purchased, the new owner would still be able to prevent an epizootic in his resident herd. Replacements could be held in quarantine for six months, sold for slaughter, or the resident herd could be vaccinated. Interested and progressive cattlemen would no doubt utilize such a service to protect their herds against leptospirosis. A test before private sales, as is done in the control of brucellosis, could also be required.

SUMMARY

1) Of 34,718 cattle tested, 4,015 (12%) were serologically positive against *Leptospira pomona*. These serums originated from 3,324 herds of which 203 (6%) contained animals which had experienced leptospirosis.

2) Grazing on irrigated pastures, the use of natural streams or ponds as a source of drinking water, and close confinement in muddy corrals were factors frequently associated with rapidly spreading epizootics.

3) *Leptospira pomona* was frequently introduced into a herd by the addition of infected replacements or through contact with other herds while grazing on summer ranges. Observations also suggested a water-borne dissemination of the disease, but whether cattle were solely responsible as the source of such contamination could not be determined.

4) Abortions were observed in most infected herds, with the greatest losses occurring in herds which were infected when most of the females were in their last trimester of pregnancy.

5) Restricting movement of cattle from infected herds until animals have ceased shedding leptospiras, surveillance of cattle sold through community and private sales, and the prevention of contamination of natural streams are suggested as possible control measures.

References

[1]Reinhard, K. R.: Newer Knowledge of Leptospirosis in the United States. Expt. Parasitol., *2*, (1953): 87-115.

[2]Morse, E. V., Allen, V., Krohn, A. F., and Hall, R.: Leptospirosis in Wisconsin. I. Epizootiology and Clinical Features. J.A.V.M.A., *127*, (1955): 417-421.

[3]Bohl, E. H., and Ferguson, L. C.: Leptospirosis in Domestic Animals. J.A.V.M.A., *121*, (1952): 421-428.

[4]Reinhard, K. R.: A Clinical Pathological Study of Experimental Leptospirosis of Calves. Am. J. Vet. Res., *12*, (1951): 282-291.

[5]Bryans, J. T.: Studies on Equine Leptospirosis. Cornell Vet., *45*, (1955): 16-50.

[6]Burnstein, T., and Baker, J. A.: Leptospirosis in Swine Caused by *Leptospira Pomona*. J. Infect. Dis., *94*, (1954): 53-64.

[7]Stoenner, H. G.: A Capillary-Tube Test for Leptospirosis. Am. J. Hyg., *57*, (1953): 316-327.

[8]Stoenner, H. G.: Application of the Capillary-Tube Test and a Newly Developed Plate Test to the Serodiagnosis of Bovine Leptospirosis. Am. J. Vet. Res., *15*, (1954): 434-439.

[9]Stoenner, H. G.: Leptospiral Antigens and the Combination Plate and Capillary-Tube Test for the Serodiagnosis of Leptospirosis. Rocky Mountain Lab. Circ. 16, (1955): 1-14.

[10]Meyer, K. F., Stewart-Anderson, B., and Eddie, B.: Canine Leptospirosis in the United States. J.A.V.M.A., *95*, (1939): 710-729.

[11]Gillespie, R. W., Ringen, L. M., and Kenzy, S. G.: Isolation of Leptospira from Cattle in Wash-

ingon—A Preliminary Report. J.A.V.M.A., *123*, (1953): 322.
[12]Ringen, L. M., Bracken, F. K., Kenzy, S. G., and Gillespie, R. W. H.: Studies on Bovine Leptospirosis. I. Some Effects of Dihydrostreptomycin and Terramycin on the Carrier Condition in Bovine Leptospirosis. J.A.V.M.A., *126*, (1955): 272-276.
[13]Bracken, F. K.: Bovine Leptospirosis in the United States. J. Dai. Sci., *38*, (1955): 821-822.
[14]Stoenner, H. G.: Unpublished data.
[15]Yager, R. H.: Symposium on the Leptospiroses. Army M. Serv. Grad. School, Walter Reed Army M. Center, Washington, D.C. (1952): 81.
[16]Reinhard, K. R.: Present Knowledge and Concepts of Leptospirosis in Farm Animals. J.A.V.M.A., *123*, (1953): 487-493.
[17]Bryan, H. S.: Studies on Leptospirosis in Domestic Animals. III. Incidence of Leptospirosis in Cattle and Swine in Illinois. J.A.V.M.A., *124*, (1954): 423-426.
[18]York, C. J.: Aspects of Control in Bovine Leptospirosis. Proc. U.S. Livestock San. A. (1951): 295-300.
[19]Galton, M. M., Acree, J. A., Lewis, A., and Prather, E. C.: Leptospirosis in Domestic Animals in Florida with Reference to Cattle. J.A.V.M.A., *128*, (1956): 87-91.
[20]Borg-Petersen, C., and Fennestad, K. L.: A Field Rodent *(Apodemus Agrarius)* as Carrier of *Leptospira Pomona* in Denmark. J.A.V.M.A., *128*, (1956): 204-205.

An Experience with a *Leptospira Pomona* Bacterin in Dairy Cattle

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Interest in leptospirosis has been stimulated by recent articles in the literature, but these have been primarily concerned with the diagnosis and clinical evidence of the disease in cattle.

This article is presented neither as a controlled experiment nor as the answer to the complex problem, but to report a field experience with a *Leptospira pomona* bacterin in a dairy herd of 650 cows, mostly of grade breeding (fig. 1).

HERD HISTORY

For about six weeks, many cows in the herd had shown symptoms suggestive of leptospirosis. Blood samples from 5 cows were sent to the Florida State Laboratory for both complement-fixation and agglutination tests and 3 cows were found positive to *L. pomona*. These 5 cows had aborted almost three weeks previous to being tested. The herd was negative to brucellosis and the cows were artificially inseminated.

Vaccination of the herd with antilepto bacterin* was considered, but the owner hesitated until abortions increased to five per day. (The author's only previous experience with the vaccine was in a herd of 115 cows with a high abortion rate which seemed to recede following vaccination.)

At the time of vaccination of the large herd, on Aug. 10, 1955, 46 cows had aborted in three weeks. Blood samples from several of these cows, taken three to four days after abortion, and before vaccination, were negative to the laboratory tests. This seems to indicate that the antibodies do not appear for several days after clinical evidence of the disease.

All 650 cows were given 5 cc. of the vaccine subcutaneously at the regular milking time, with a loss in milk production at this milking only. In the following ten days, 9 cows aborted and then the abortions stopped. When the abortions occurred, approximately 200 of the 650 cows were in the last two months of gestation and 350 had been pregnant two to seven months. The remaining 100 had not been bred. The abortions occurred mostly in younger cows and heifers, but at all stages of gestation.

The owner was so well pleased with the apparent results that all herd additions (about 150 heifers) were vaccinated and the entire herd was revaccinated in six months, on Feb. 15, 1956.

There were no reactions from either the first or second vaccinations and no abortions occurred in the 30 days following the second vaccination.

Fig. 1—Herd of dairy cattle in which leptospirosis occurred.

Dr. Teigland is a general practitioner in Opa Locka, Fla.

*Antilepto is a product of Sharp and Dohme, Philadelphia, Pa.

DISCUSSION AND CONCLUSIONS

1) In a herd of 650 milk cows, abortion in almost 10 per cent of the pregnant cows occurred in a 30-day period, mostly in young cattle.

2) Diagnosis of leptospirosis was based on clinical evidence and on positive complement-fixation and agglutination-lysis tests on 5 cows that had aborted three weeks previously.

3) The entire herd was inoculated with antilepto bacterin on Aug. 10, 1955, and revaccinated six months later.

4) There were no reactions from the two vaccinations and there was little loss of milk production at the time of vaccination.

5) The abortion rate dropped to nearly zero within ten days of the first vaccination.

6) Following vaccination, the owner reported that his cows were, in general, much healthier, which suggests that various subclinical forms of leptospirosis may have been occurring previously.

7) Vaccination against *Leptospira pomona* was apparently safe and effective.

8) It is recognized that a recession in abortion may have been coincidental and not associated with the vaccination. However, new heifers (150) which should have been susceptible to the disease were vaccinated and have not shown symptoms of leptospirosis in any form. All herd additions are vaccinated as they are purchased.

10) The author feels that proof of the vaccine's effectiveness must be made by research workers, but it is hoped that this experience may be of some help to other practitioners.

Reviewer's Comments

Unless the epizootiology of bovine leptospirosis is thoroughly understood, one would be inclined to conclude that the remission in signs of leptospirosis resulted from the vaccination. Since signs suggestive of leptospirosis had occurred for six weeks in this herd, it is probable that the epizootic was nearly over when vaccine was administered. At this stage, most of the animals are either immune or have been exposed, and it is doubtful that the vaccine altered the course of the disease in the herd.

Teigland's observations are similar to those seen in a herd of Hereford cattle. On Nov. 19, 1953, 130 head of adult females, which had been grazing on several sections of semiarid sagebrush range, were tested routinely for brucellosis. At that time, the owner noticed that 2 had apparently aborted since both had retained fetal membranes. On December 15, the herdsman noticed that several more cows had retained membranes. The herd was again taken in from the range for examination and a total of 15 were found to have aborted. Since the co-owner of the herd was away, no action was taken until he returned on December 21. They concluded that since the herd was free of brucellosis, leptospirosis was the likely cause of abortion. The cattle were brought in again from the range and during the six-day interval, 16 more had aborted. Animals which had not aborted were vaccinated and blood samples were taken for leptospiral serology. Of 97 cows which were vaccinated and tested that day, only 28 were negative. During the next few postvaccination days, 5 more cows calved prematurely and then abortions ceased. The owner was certain that the vaccine had stopped the abortions, but only 28 susceptible cows remained in the herd and these were likely exposed or in the incubative stage of disease.

I realize that it is difficult for the practitioner to conduct controlled studies on a product once it has been released by the U.S.D.A.; however, he could measure the progress of the epizootic by serology. Even then, one can not safely assume that animals which were serologically negative at the late epizootic period would abort at the same rate as those earlier infected. In my opinion, Dr. Teigland does not provide sufficient proof that the "apparent results" he obtained resulted from vaccination.

I do not infer that the commercial vaccines are impotent. Experimental studies indicate that these vaccines are capable of stimulating a reasonably solid immunity. Because leptospirosis often spreads rapidly, vaccine must be used early if any benefit is to be derived.

A Report on Leptospirosis in a Herd of Shetland Ponies

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This is a report of recurrent leptospirosis in a herd of 25 Shetland pony mares as observed and treated over a period of two years. The report was prepared with the extremely confusing help of the owner, in matters of herd record.

The herd is maintained for "horse-trading" purposes on a permanent pasture setup of some 20 acres surrounding a shallow reservoir. Leptospirosis had been present in the herd, as nearly as could be determined, for approximately two years prior to our connection with it.

On the initial call, in April, 1955, a mare and her 18-hour-old foal were presented for treatment. The foal showed an extreme

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icterus. The temperature was subnormal, the pulse weak, and respiration was shallow. On abdominal palpation, there was obvious pain. Death occurred before treatment could be started. Necropsy revealed gross pathological changes similar to those occurring in calves suffering from leptospirosis. There was generalized icterus, hematuria, an abundance of serous fluid in the peritoneal cavity, petechiae in the kidneys, and a dull, light-colored liver. The mare was treated for retention of the fetal membranes and responded satisfactorily.

One week later, another mare foaled, apparently normally. However, in about 12 hours the foal was dull, listless, and lying with its head extended, giving the appearance of a "sleeper." Twice the owner had noticed it nursing, but without much vigor. Its temperature was 105.4 F., and it had a marked icterus, shallow respiration, and a thin beady pulse.

Treatment consisted of polyotic® (4 mg./lb.), intramuscularly, and 100 cc. of glucose (40%), intravenously. Twelve hours later, the foal was able to rise by itself and the polyotic therapy was repeated. By 24 hours after initial treatment, improvement was marked, temperature 101.2 F., appetite good, icterus subsiding, and the foal was quite lively. Glucose and polyotic were again administered. Recovery seemed complete.

HERD HISTORY

An effort to obtain a complete herd history, as nearly as the owner could recall it, revealed the following:

A mare aborted a 10½-month fetus on March 12, 1954. Ten days later, a second mare foaled apparently normally but, when 2 days old, the foal developed a progressive weakness, posterior paralysis, and died at 1 week of age.

On April 3, a third mare foaled normally. This foal developed a posterior weakness and incoordination when 4 days old, staggered around without treatment for two weeks, and finally seemed to recover. It was sold as a weanling.

On April 14, a fourth mare foaled and both mare and foal died that day.

The next mare foaled about the middle of May with no difficulty, and from then on the remaining 13 mares to foal did so in normal fashion.

In 1955, this history was repeated in much the same way. On February 10, mare 1 aborted when about ten months pregnant. Four days later, mare 2 foaled normally, but both the mare and foal died a week later. Mare 3 foaled March 10, but the foal died within 24 hours. Mare 4 foaled March 16, but her foal died when 48 hours old.

Between March 16 and April 12, 2 mares had normal foals which remained healthy.

In every instance, except one, these mares passed their fetal membranes, came into heat, and rebred normally.

TREATMENT

On the original call, April 12, 1955, blood samples were taken from the stallion and 5 mares, including mares 1, 3, and 4. These and all subsequent specimens were sub-

TABLE 1—Test* for Leptospira Pomona in a Pony Herd, June, 1956.

No.	Animal	Test result	Age	Remarks
1	Mare	Sus.	9 yr.	Barren; vac. Jan., 1956.
2	Mare	Neg.	6 yr.	Vac. May, 1955, and Jan., 1956; foaled March, 1956; agalactia.
3	Filly	Neg.	3 yr.	Vac. Jan., 1956; foaled June 24, 1956.
4	Filly	Neg.	2 yr.	Not vac.; bred but not pregnant.
5	Mare†	Neg.	15 yr.	Vac. Jan., 1956; foaled May 7, 1956; again pregnant.
6	Colt	Neg.	3 mo.	Not vac.; no illness.
7	Mare	Sus.	14 yr.	Aborted April, 1955; vac. May, 1955, and Jan., 1956, foaled April, 1956.
8	Mare†	Pos.	15 yr.	Barren past 3 yr.; vac. Jan., 1956.
9	Mare	Neg.	12 yr.	Aborted Feb., 1955; vac. May, 1955, and Jan., 1956; foaled March, 1956; again pregnant.
10	Filly	Neg.	2 yr.	Not vac.
11	Mare†	Pos.	10 yr.	Vac. Jan., 1956; foaled March, 1956; again pregnant.
12	Mare†	Pos.	6 yr.	Vac. Jan., 1956; foaled March, 1956; again pregnant.
13	Mare	Pos.	16 yr.	Vac. May, 1955; foaled June, 1955; revac. Jan., 1956; due to foal Aug., 1956.
14	Mare	Neg.	18 yr.	Vac. May, 1955, and Jan., 1956; barren last year; due to foal in Oct., 1956.
15	Filly	Neg.	3 mo.	Not vac.; no illness.
16	Mare†	Neg.	6 yr.	Vac. Jan., 1956; foaled April, 1956; agalactia; again pregnant.
17	Mare†	Neg.	4 yr.	Vac. Jan., 1956; foaled May, 1956; agalactia; again pregnant.
18	Colt	Neg.	2 mo.	Dam agalactia; foal doing well on supplemental feeding.
19	Mare	Neg.	10 yr.	Vac. May 1955; foaled June, 1955; revac. Jan., 1956; foaled June, 1956.

Summary of Table 1.—Of the 14 mares vaccinated in January, 1956, only 4 were positive and 2 suspicious five months later. Of 2 mares which aborted early in 1955; and were twice vaccinated since, 1 was negative and 1 suspicious.

*Serum plate (complement-fixation) test, using 1:40 as the critical dilution. Also checked by, and in agreement with, the agglutination-lysis test.

†Not in herd at time of first vaccination, May, 1955.

mitted to a state diagnostic laboratory.* The samples taken from the stallion and 3 mares were negative to the test for *Leptospira pomona;* only mares 1 and 3 were positive.

On April 28, blood samples were taken again. The stallion and the two apparently normal mares were still negative, but mare 4 was now positive. Two other mares that aborted (table 1) were not tested.

It was then decided to vaccinate all the adult ponies in the herd, even though no information was available as to the vaccine's effectiveness in the equine species. Leptogen, in the dosage prescribed for cattle, was used on May 9, 1955, with no untoward reactions attributable to the bacterin. The premises were given an industrious renovating. The reservoir and swampy areas were drained, and fresh water only was made available.

The remaining 13 mares had normal foals, the first of which was born on May 18. During the summer and fall of 1955, all the foals that had been sick but recovered were sold, as were mares 1, 3, and 4. In their place, 7 new pregnant mares were acquired. The new mares were not vaccinated against leptospirosis.

All went well until Jan. 10, 1956, when 1 of the newly purchased mares became ill. Examination revealed a temperature of 104.2 F. and icterus of the conjunctiva, sclera, buccal mucosa, and vaginal wall; also anorexia, extreme dullness, and depression.

Treatment consisted of polyotic (2 mg./lb.) intramuscularly and 1,000 cc. of dextrose (10%) in saline, intravenously. Impending abortion was suspected. Since the mare's temperature was 101.6 F. on the following day and improvement was evident, this treatment was repeated. The third day, examination with a vaginal speculum revealed a dilating cervix and a uterine discharge. Stilbestrol was administered along with polyotic (2 mg./lb.) and 500 cc. of saline solution.

Abortion occurred during the night. The mare got out of the barn into a driving rainstorm and was found prostrate in a puddle of rainwater in the morning. She died without further treatment. Necropsy showed peritoneal changes much the same as those reported above for the foal. There was also pulmonary involvement.

*The State Livestock Pathology Laboratory, Fresno, Calif.

The remaining newly purchased mares and the fillies of breeding age were immediately vaccinated (Jan. 16, 1956) for leptospirosis, and the mares vaccinated the previous year were revaccinated. Thus, only the stallion and the mares of breeding age have been vaccinated. To date, there has been no recurrence of the problem.

CONCLUSIONS

Assuming that this herd problem is leptospirosis, it should be considered as one of the primary causes for abortion in the mare and postnatal infection in the foal.

It would seem that vaccination is effective in controlling the spread of this disease. Of the 14 mares vaccinated on Jan. 16, 1956, 11 have foaled, all normally, and their unvaccinated foals have remained normal.

It would also seem that it is possible to successfully treat leptospirosis in the young foal.

After this paper was submitted to the JOURNAL and returned with the reviewer's comments, it was decided to blood-test all the mares in the herd, as well as some of the foals, for leptospirosis. The results of the test on June 13, 1956, are shown (table 1).

Reviewer's Comments

Under the environmental conditions described, I doubt that leptospirosis could have existed for two years in such a small herd, as the disease should have become self-limiting long before.

No laboratory studies were made, on any of the foals which died, to prove a diagnosis of leptospirosis. Since a disease in newborn foals, such as described here, has not previously been associated with equine leptospirosis, it seems necessary to base a diagnosis upon more than mere association with the presence of antibodies in the dams.

Mare 4 foaled March 16 and her foal died at 48 hours of age. If one assumes that this foal died of leptospirosis, it must have been infected *in utero.* Yet this mare was serologically negative on April 12. On April 28, when she was again tested, she was positive, which suggests that she was infected after foaling. It would have been interesting if the serological status of the foal which was treated and recovered had been determined.

Part of the problem may have been attributable to leptospirosis, but I am inclined to think that more than one etiological factor was involved.

I seriously doubt that the vaccine had any effect after the disease had existed in the herd for more than a year.

The Control and Treatment of Swine Leptospirosis During a Naturally Occurring Outbreak

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The importance of swine leptospirosis as a cause of abortion or the birth of weak, unthrifty pigs has been stressed in a number of recent papers.[1-3] This report deals with observations made on naturally occurring leptospirosis in a group of 29 bred gilts, together with a report of their treatment with antibiotics and the use of a Leptospira bacterin in attempts to prevent the spread of the disease to other swine in the herd.

HISTORY

On Feb. 7, 1956, gilt 49 was reported to be "off feed" and "humped up" in her back. The gilt returned to normal the following day.

On February 15, gilt 114 was obviously ill and the herdsman called a veterinarian. The gilt's temperature was 105.4 F., she was standing with her back arched, and her urine had a pronounced hemoglobin color. Anorexia and a general depressed attitude were apparent. The tentative diagnosis was kidney infection and the gilt was given 1.5 million units of penicillin and 1 Gm. of streptomycin. Within 48 hours, she appeared to be completely recovered.

On February 20, gilt 49 aborted 7 dead pigs after 87 days of pregnancy and 13 days after she had been clinically ill. This abortion and the clinical syndrome in this gilt, and in gilt 114, suggested leptospirosis. An agglutination-lysis test on the blood serum of gilt 49 revealed antibodies at a titer of 1:6,400.

Blood samples from the remaining 28 gilts were collected February 23 and were tested for leptospiral antibodies in an agglutination-lysis test. Of the 28 gilts, 18 were positive, with titers ranging from 1:400 to 1:25,600; 7 were negative; and 3 were suspicious, with antibodies present in the 1:10 dilution only. The diagnosis was confirmed on March 1 and 2 when viable leptospiras were demonstrated in the urine of 8 of 12 gilts examined. Subsequently, *Leptospira pomona* was cultured from hamsters injected with urine from the infected gilts.

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The authors acknowledge the assistance of Professor W. L. Robison, Dr. H. S. Teague, and Mr. G. W. Todd in parts of this work.

TREATMENT

The gilts were separated by a temporary partition into two groups on March 2. By this date, gilt 94 had aborted and both she and gilt 49, the first gilt to abort, were placed in the group to be treated. The remainder of the animals were placed largely on the basis of equalizing the serological titers in the two groups; therefore, 3 negative gilts were placed in the "treated" group and 4 in the control group.

Chlortetracycline (aureomycin®*) was supplied to the "treated" group by thoroughly mixing 16 lb. of aureofac-10® in 800 lb. of the ration fed to the breeding sows. By calculation, this gave a concentration of 400 Gm. of chlortetracycline per ton of feed. The 15 gilts were given the medicated feed free choice, and the 800 lb. lasted ten days, at which time the animals were returned to the regular ration. During the ten-day period of treatment, the 15 gilts consumed 160 Gm. of chlortetracycline, an average of just over 1 Gm. per animal per day. The blood levels of chlortetracycline were not determined on these animals but, in a previous experiment,[4] the same level of antibiotic in feed for fattening hogs produced levels of 0.28 to 0.51 *gamma* per milliliter of blood serum.

By March 28, when another serological test was made, all of the animals had antibodies at a level of 1:1,600 or above, except gilts 196 and 320 which showed no leptospiral antibodies at a level greater than 1:50. Presumably, these gilts were in the early stages of infection when treatment was started and the chlortetracycline prevented localization of the leptospiras.

Blood samples were collected from all gilts about two months (May 7) following the treatment with chlortetracycline. The antibody titer of 7 of the 14 treated gilts had decreased to 1:200 or less, whereas only 3 of the untreated gilts had titers this low. These 10 animals were returned to the breeding herd.

Leptospiras were demonstrated in the urine of 8 of the 14 untreated gilts one or more times during the period of observation (table 1).

Among the treated gilts, the urine of 7 was examined prior to treatment and leptospiras were found in 4, whereas during the week after termination of treatment,

*Aureomycin is produced by the American Cyanamid Co., Pearl River, N.Y.

the urine of 9 was negative on dark-field examination but a few living leptospiras were seen in the urine of gilt 307. About two months later (May 22), 5 urine samples were collected from the treated group and 4 of these contained leptospiras.

FARROWING RECORD

Five normal litters were farrowed in the treated group as compared with two in the untreated gilts. At 1 week of age, the treated gilts had 34 pigs living while the untreated controls had only 16. Three gilts in each group did not farrow. This high proportion of "open" gilts may have been due, in part, to leptospirosis. Early fetal death and resorption, or unnoticed early abortion, may have accounted for some of these reproductive failures.

The earliest of the 14 abortions occurred at 85, 87, and 91 days and the 11 others between 100 and 111 days of pregnancy.

LEPTOSPIRA BACTERIN

There were 57 bred sows or gilts and 10 boars in the same herd, but penned separately from the infected gilts. These animals were all tested against *L. pomona* during the last week of February. Two boars, which had been purchased and added to the herd during the fall of 1955 just prior to the breeding season, reacted at a dilution of 1:25,600. All other animals were negative.

On March 1, 1956, 54 of the animals were given 5 cc. of a Leptospira bacterin† and 11 animals were left as controls, 1 or more in each of the various pens. No local or general reactions were noticed following vaccination.

Of the 54 vaccinated animals, 26 were tested with *L. pomona* on April 13, about six weeks after vaccination. Of the 26, 1 unvaccinated and 2 vaccinated sows, in a pen adjoining that of the infected gilts and separated only by a woven wire fence, were positive at titers of 1:800 to 1:3,200. These animals apparently became infected between the time of the first serological test

†Leptogen® is produced by the Pitman-Moore Co., Indianapolis, Ind.

TABLE I—Summary of Observations on Group of Bred Gilts Infected with Leptospira Pomona

Gilt No.	Titer* Feb. 23	Dark-field examination of urine				Titer May 7	Results of pregnancy		
		Mar. 2	Mar. 15	Mar. 20	May 22		No. dead pigs	No. living pigs	No. pigs, 1 week
TREATED**									
6	25,600	+	—	.....	.....	800	7	—	—
8	6,400	—	.....	.....	.....	200	—	6	6
19	6,400	.....	—	.....	.....	400	7	—	—
49	6,400	+	.....	.....	+	1,600	7	—	—
94	25,600	—	.....	.....	.....	1,600	6	—	—
114	1,600	—	—	.....	—	200	7	—	—
131	0	.....	.....	.....	.....	100	—	10	7
168	0	.....	.....	—	.....	100	—	10	9
174	0	.....	.....	—	.....	Sold	Open	—	—
196	10	.....	—	—	.....	50	—	8	7
258	6,400	+	—	.....	+	3,200	Open	—	—
307	1,600	+	+, few	+, few	+	1,600	8†	—	—
320	10	.....	—	—	.....	50	—	5	5
328	1,600	.....	.....	.....	.....	50	Open	—	—
390	6,400	.....	—	.....	+	3,200	8†	—	—
CONTROLS									
7	6,400	.....	.....	—	.....	200	Open	—	—
10	6,400	.....	+	.....	+	1,600	Open	—	—
104	400	+	+	.....	+	800	3	1	1
116	6,400	.....	+	+	.....	3,200	7	—	—
149	0	.....	.....	.....	.....	1,600	5	1	1
170	0	+	+	+	.....	3,200	6	4	—
189	0	.....	+	.....	+	1,600	4	—	—
247	10	—	.....	+	.....	1,600	11	3	—
273	25,600	.....	.....	—	.....	400	1	1	1
319	1,600	.....	.....	.....	.....	200	—	9	7
359	1,600	.....	—	.....	.....	200	Open	—	—
391	6,400	+	+	+	.....	Sold	8†	—	—
392	0	.....	—	+	—	1,600	5	—	—
492	1,600	.....	—	.....	.....	400	—	6	6

*The titers are expressed as the reciprocal of the highest dilution which caused agglutination or lysis of 50 per cent or more of the leptospiras.

†The exact number of aborted fetuses was not recorded; these figures are estimates.

**The "treated" group was given a ration containing aureomycin (400 Gm./ton) for 10 days starting March 2 (1 Gm./sow/day).

and the time of vaccination. The other 9 sows in this pen, and other sows and boars tested, had titers from less than 1:10 to a weak reaction in 1:100. Most of the vaccinated animals had at least a trace of agglutination in the 1:10 dilution.

At two and one-half months following vaccination, all of the vaccinated and control animals were negative at the 1:10 dilution of serum in the agglutination-lysis test, except the 3 which were previously shown to be infected. Of the 3, the 2 vaccinated sows were probably recovering, as indicated by a reduction in titer to less than 1:800, while the unvaccinated control retained a titer of 1:3,200.

DISCUSSION

Leptospirosis was introduced into a herd of susceptible swine, presumably by 1 or possibly by 2 boars which were purchased from outside sources. They were kept in adjoining lots separated by a woven wire fence. On the first herd test, both of the boars were strongly positive and it was, therefore, impossible to determine whether both were infected when purchased or whether one became infected from the other.

Not all of the sows bred by these boars were infected. However, there was serological evidence that 1 or a few of the gilts became infected at the time of breeding, and subsequently the infection spread through all 29 gilts in the one pen and from these to 3 sows in the adjoining pen. When first diagnosed in the herd, the disease was apparently at a highly communicable level, since probably half of the gilts were shedding leptospiras in the urine. Some of the urine samples contained numbers of living leptospiras which approached that found in a laboratory culture. The urine from the various gilts ranged in pH from 7.0 to 8.2, making a suitable medium for the survival of the leptospiras.

Oral treatment with chlortetracycline at the rate of approximately 1 Gm. per gilt per day, for a period of ten days, was not effective in completely eradicating the disease. However, the incidence of kidney localization was reduced and 7 of the 15 gilts were returned to the breeding herd as compared with only 3 of 14 in the control group. The treatment also appeared to reduce the effect of *L. pomona* on the fetuses, since five normal litters were farrowed in the treated groups compared with two in the control group. Had higher levels of the antibiotic been used, it is possible that the therapy would have been more effective.

The Leptospira bacterin seemed to control the spread of the infection in the brood sows, even though *L. pomona* was present in the pen of 12 sows adjoining the infected gilts when the bacterin was given. Except for the 3 sows which became infected at or near the time of vaccination, there has been no other evidence of infection to date.

CONCLUSIONS

Chlortetracycline, fed at a level of 400 Gm. per ton of feed (1 Gm./sow/day) did not satisfactorily eradicate the kidney carrier state in the group of 15 gilts. The treatment was followed by a reduction in the rate of abortion and neonatal mortality.

The use of Leptospira bacterin apparently controlled the spread of *Leptospira pomona* in otherwise susceptible swine.

Boars, or other swine, should not be added to a susceptible herd until found serologically negative to *L. pomona* after 14 days of isolation.

References

[1]Bryan, H. W., Rhoades, H. E., and Willigan, D. A.: Isolation of *Leptospira Pomona* from Aborted Swine Fetuses. Vet. Med., *48*, (1953): 438.

[2]Bohl, E. H., Powers, T. E., and Ferguson, L. C.: Abortion of Swine Associated with Leptospirosis. J.A.V.M.A., *124*, (1954): 262-264.

[3]Ryley, F. W., and Simmons, G. P.: *Leptospira Pomona* as a Cause of Abortion and Neonatal Mortality in Swine. Queensland J. Agric. Sci., *11*, (1954): 61-74.

[4]Smith, H. R., Ferguson, L. C., and Sanger, V. L.: The Effect of High Levels of Aureomycin (Chlortetracycline) in the Ration on Development of Immunity Following Vaccination Against Hog Cholera. J.A.V.M.A., *129*, (1956): 162-166.

Induced Leptospirosis in Swine.—Swine experimentally infected with *Leptospira pomona* in Australia developed few symptoms, except abortions and dead or weak pigs when sows were infected at midpregnancy. The most common lesions were: in the fetuses and pigs, focal hepatitis and serous exudates in body cavities; in older pigs, interstitial nephritis. Serum titers were usually high in a few weeks and some remained high for at least a year.

Studies on Bovine Leptospirosis II. The Effect of Various Levels of Tetracycline Hydrochloride on Bovine Leptospirosis

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At the present time, there is no known satisfactory treatment for bovine leptospirosis. A successful treatment should not only alleviate the clinical course of the disease but should also prevent the development of the carrier condition. Hall *et al.*[1] reported that none of the antibiotics they used in the treatment of human leptospirosis was effective in changing the clinical course of the disease. Erdheim[2] reported that, although penicillin does not eliminate the carrier state in bovine leptospirosis, it will alleviate the clinical symptoms if a high level is given early during the course of the disease.

Bryan,[3] using several different antibiotics, both singly and in combination, reported no significant effect on the course of the disease. He used blood serum titers, based on agglutination-lysis tests, as his criterion for effectiveness. Mills[4] reported that he had used streptomycin on acute cases without any apparent success. However, experiments by Ringen *et al.*[5] suggested that dihydrostreptomycin, but not low levels of terramycin,® could eliminate bovine leptospiruria. The following investigation was an attempt to determine the effect of various levels of tetracycline hydrochloride on bovine leptospirosis.

Also, little is known concerning the route of bovine infection with leptospiras. Baker and Little[6] postulated that cattle could be infected by having infective urine splashed into their nose or eyes or by standing in water which contained leptospiras. Burnstein and Baker[7] found that swine could be infected through intranasal inoculation, but only 1 of 7 pigs became infected when the organisms were given orally.

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The following experiments were carried out using various routes in an attempt to determine the natural route of infection which occurs under field conditions.

Experimental Methods

The animals used were mainly yearling grade Herefords, negative to the agglutination-lysis test[8] four weeks prior to, and at the time of, exposure. *Leptospira pomona* was used as the antigen and for all blood serum titer determinations.

The inoculum used for infecting the cattle consisted of *L. pomona*, either in cultural form, or in blood collected on the day of death of an experimentally infected calf, or in urine from a known case of bovine leptospiruria.

The cattle were exposed either by a single inoculation or once daily for five days. Animals which did not respond to the single dose were also given multiple exposures. The inoculum was either placed in the conjunctival sac, nebulized in a nostril, or the animal was given one and a half- to two-minute exposure by placing a foot in a bucket containing diluted urine, the foot having been shaved to insure minute openings in the skin.

Infection was determined by thermal response and by rising blood serum titers. Leptospiruria was determined by daily dark field examination of the urine, together with weekly inoculations of urine into weanling guinea pigs which were then tested for rising blood serum titers.[5]

After leptospiruria was demonstrated, the animals were treated intramuscularly with tetracycline hydrochloride at levels of 1.0, 2.0, 2.5, or 5.0 mg. per pound of body weight once daily for five days.

Experimental Results

Treatment was considered effective only if the leptospiruria was stopped during and after the administration of the antibiotic. For the 3 animals treated at the 5.0-mg. level and 2 at the 2.5-mg. level, there was no evidence of leptospiruria after treatment (table 1). However, leptospiruria was demonstrated for two weeks or longer in all 4 animals treated at the 2.0-mg. level and in 4 of 6 treated at the 1.0-mg. level and, in 3 of these, it continued for eight to 12 weeks, whereas the 4 control animals excreted demonstrable leptospiras in their urine for an average of 33 days, 3 for at least four weeks, and 1 for a minimum of seven weeks.

Approximately one half of the animals required repeated exposures before they became infected by these routes (table 2). Four animals were not infected, even after multiple exposures; they developed no blood serum antibody titer.

The only clinical response of these experimental animals was thermal, and this

did not occur in all of them. The rectal temperature of some was determined every 12 hours and the actual peak would have been missed if the temperature had been taken only once daily, *i.e.*, the 36-hour temperature curve for 1 animal went from 104.8 to 105.6 to 104.9 F.

No significant difference in the rate of infection, severity, or duration of leptospiruria could be observed when these cattle were exposed to *L. pomona* from artificial mediums or from acute or chronic cases of bovine leptospirosis. Bovine passage did not seem to enhance the virulence of this organism for the experimental cattle.

DISCUSSION

It has been reported that infected cattle may excrete leptospiras in their urine for at least three months[9] but, usually, for only one to two months. Since one of the problems in the control of leptospirosis is the elimination of these carrier animals, this was attempted with various levels of tetracycline hydrochloride. There was no evidence of leptospiruria after treatment with the two higher levels but the lower levels of treatment may even have prolonged the leptospiruria period. This becomes significant, since a treated animal may show an apparent recovery but continue to spread the spirochetes.

The ease with which some animals become infected, while others require repeated exposures, may partially explain how the infection is maintained in herds for long periods. Under range conditions, the infection probably spreads quite slowly but, when the animals are crowded together and exposure is increased, explosive outbreaks may occur. Some animals probably become infected by standing in infective water or by having infective urine splashed into the eyes or nostrils. These animals then start spreading the spirochetes. Some animals may have a degree of natural immunity, since 4 could not be infected. However, their first exposure may have immunized these animals.

TABLE 2—Infection Produced by Various Routes of Exposure of Leptospira Pomona

Route of exposure	Inoculum		
	Culture	Blood	Urine
Conjunctival sac	2/2(s)[a]	2/6(s)[b]	3/5(s)[b]
Nostril	3/5(s)[b]	.....	3/3(m)
Foot	.....	.....	2/6(s)[c]

[a]Numerator = animals infected; denominator = animals exposed; (s) = single exposure; (m) = multiple exposures.

[b]Animals not infected by one exposure became infected after multiple exposures (i.e., nostril, culture—3 of 5 by single, other 2 by multiple exposure).

[c]Four animals could not be infected.

SUMMARY

Cattle experimentally infected with *Leptospira pomona* were treated with different levels of tetracycline hydrochloride after leptospiruria had been demonstrated. The antibiotic was given once daily for five days at the rate of 1.0, 2.0, 2.5, or 5.0 mg. per pound of body weight. There was evi-

TABLE 1—The Effect of Various Levels of Tetracycline Hydrochloride on Bovine Leptospiruria

Treatment	Animal No.	Weeks of leptospiruria																									
		0		1		2		3		4		5		6		7		8		9		10		11		12	
		DF[a]	GP[b]	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP	DF	GP
Control	6	—	+	—	+	—	+	—	+	—	+	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----
	88	—	+	—	+	—	+	—	+	—	+	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----
	158	—	+	—	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----
	167	—	+	—	+	+	+	+	+	+	+	+	+	—	—	+	—	—	—	—	—	—	—	—	—	—	—
1.0 mg.[c]	98	—	+	+[d]	+[d]	—	—	—	+	—	+	—	+	—	—	—	—	—	—	—	—	—	—	----	----	----	----
	99	—	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----	----	----	----	----
	100	—	+	—[d]	+[d]	—	—	—	—	—	+	—	+	—	—	—	—	—	—	—	—	—	—	----	----	----	----
	138	—[d]	—[d]	—	—	—	—	—	—	—	+	—	+	—	—	—	+	—	—	—	+	—	+	—	+	—	+[d]
	139	—	+	—[d]	+[d]	—	—	—	—	—	—	—	+	—	—	—	+	—	+	—	—	—	—	—	—	—	—
	140	—	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----	----	----	----	----
2.0 mg.[c]	160	—	+	—	+	—[d]	+[d]	—	—	—	—	—	—	—	—	—	—	—	+	—	—	—	—	+	—	—	—[e]
	161	—	+	+[d]	+[d]	—	—	—	—	—	+[f]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----
	163	—	—	—	—	—[d]	+[d]	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	----	----	----	----
	166	—	+	—	+	+[d]	+[d]	—	+	—	—	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----
2.5 mg.[c]	119	+	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----	----	----	----	----
	122	—	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----	----	----	----	----
5.0 mg.[c]	85	—	+	—	+	—	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----
	86	—	+	—	+	—	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----
	89	—	+	—	+	+	+	+[d]	+[d]	—	—	—	—	—	—	—	—	—	—	----	----	----	----	----	----	----	----

[a]=Dark field examination of urine: + = leptospiras observed; — = no leptospiras observed. [b]Guinea pig inoculation of urine: + = rising titer; — = no demonstrable titer. [c]Milligrams of polyotic per pound of body weight given once daily for five days. [d]=start of treatment. [e]No demonstrable leptospiruria for the next five weeks. [f]Leptospiras observed by dark field examination on the thirty-third day.

dence of leptospiruria after treatment in 8 of 10 animals treated with the two lower levels but not in 5 animals treated with the two higher levels.

Cattle were infected with *L. pomona* when relatively small numbers of this organism were placed in the conjunctival sac, or were nebulized in a nostril, or when a shaved foot was held in a bucket of diluted urine for one and a half to two minutes. However, about one half of the animals required repeated exposures before they became infected.

References

[1]Hall, H. E., Hightower, J. A., Rivera, R. D., Byrne, R. J., Smadel, J. E., and Woodward, T. E.: Evaluation of Antibiotic Therapy in Human Leptospirosis. Ann. Int. Med., *35*, (1951): 981.

[2]Erdheim, M., N.A.V. Forum: Bovine Leptospirosis. North Am. Vet., *34*, (1953): 862.

[3]Bryan, H. S.: Studies on Leptospirosis in Domestic Animals. V. Experimental Antibiotic Therapy in Chronic Bovine Leptospirosis. Vet. Med., *50*, (1955): 349.

[4]Mills, A. M.: Newer Treatments Employed in Cattle Practice. Vet. Med., *49*, (1954): 57.

[5]Ringen, L. M., Bracken, F. K., Kenzy, S. G., and Gillespie, R. W. H.: Studies on Bovine Leptospirosis. I. Some Effects of Dihydrostreptomycin and Terramycin on the Carrier Condition in Bovine Leptospirosis. J.A.V.M.A., *126*, (1955): 272.

[6]Baker, J. A., and Little, R. B.: Leptospirosis in Cattle. J. Exptl. Med., *88*, (1948): 295.

[7]Burnstein, T., and Baker, J. A.: Leptospirosis in Swine Caused by *Leptospira Pomona*. J. Infect. Dis., *94*, (1954): 53.

[8]Rocky Mountain Laboratory, Leptospira Unit: Leptospirological Techniques. Circ. Letter, 1952.

[9]Sutherland, A. K., Simmons, G. C., and Kenny, G. C.: Bovine Leptospirosis. Austral. Vet. J., *25*, (1949): 197.

Effect of Aureomycin and Polyotic in an Outbreak of Leptospirosis of Swine

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Efforts directed toward the control of leptospirosis should include protection of susceptible animals and the elimination of the carrier state in infected animals. Persistence of leptospiras in the kidneys and their elimination in the urine are the main criteria of a carrier animal. Swine are considered a natural host or reservoir of *Leptospira pomona*[1] and are, therefore, well suited for survival of the parasite.

Streptomycin and aureomycin*** were found[2,3] to be effective in clearing the urinary carrier state in hamsters and dogs infected with *Leptospira canicola* and *Leptospira icterohaemorrhagiae*. Using darkfield examination of urine as the criterion,[4] dihydrostreptomycin was also found to eliminate the *L. pomona* carrier state in cattle, but with terramycin†† the urinary output of organisms was only reduced, not eliminated. Others[5] were unable to reduce, permanently, the antibody titers in cattle with *L. pomona* infection by treatment with penicillin, streptomycin, aureomycin, terramycin, or bacitracin. No urine examinations were made.

The following investigation was conducted in an attempt to evaluate the effect of polyotic*** and aurofac®-10*** on the carrier state of *L. pomona* infection of swine.

Materials and Methods

Antibiotics.—Aurofac-10, containing 10 Gm. of aureomycin per pound in a soybean-citrus meal vehicle, was fed at the rate of 200 mg. of aureomycin per pound of grain ration (400 Gm./ton) free choice for 14 days. For pigs weighing 200 lb., the average daily intake of medicated feed was 7.5 lb. Therefore, the approximate dosage of aureomycin was 7.5 mg. per pound of body weight daily.

Polyotic was administered intramuscularly at a dosage of 3 mg. per pound of body weight for five days.

Diagnostic Test Procedures.—Blood for serological testing was drawn from the anterior vena cava. The serum was tested for leptospiral antibodies by the agglutination test, using formalized antigen.[6]

Urine was collected in sterile beakers during the normal urination process. Kidney tissues were collected at the time of slaughter.

Isolation of Leptospiras.—A 10 per cent emulsion in saline was made with kidney tissues. Using either kidney tissue emulsion or urine, 0.2 ml. was inoculated intraperitoneally into 1-day-old chicks. Seven days after inoculation, the chicks were bled from the heart and Schuffner's medium was inoculated with the blood. The cultures were incubated at 30 C. for 28 days, during which time they were examined for the presence of organisms. Usually, growth of leptospiras was evident within two weeks. Cultures were considered negative if no organisms could be detected by the end of the 28-day observation period.

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*Aureomycin (chlortetracycline) and polyotic (tetracycline), Lederle Laboratories, Pearl River, N. Y.

†Terramycin (oxytetracycline), Charles Pfizer and Co., Inc., Brooklyn, N. Y.

**Aurofac-10 feed supplement, Fine Chemicals Division, American Cyanamid Co., Pearl River, N. Y.

TABLE 1—Pretreatment Antibody Titers of Leptospira Pomona and Leptospiral Isolations from Kidney Tissues of Fat Hogs

Pen	Treatment	No. of hogs	L. pomona titer pretreatment	Leptospiral isolations at slaughter
A	Control	17	1:10,000	12
		6	1:1,000	0
		5	1:100	1
B	Aurofac-10 200 mg. aureomycin /lb. of feed for 14 days	15	1:10,000	0
		5	1:1,000	0
		3	1:100	0
C	Polyotic 3 mg./lb. body wt. i.m. daily for 5 days	12	1:10,000	0
		4	1:1,000	0
		4	1:100	0

EXPERIMENTAL PROCEDURE AND RESULTS

Leptospirosis was suspected when abortions and the birth of dead pigs occurred in a well-cared-for herd of Brucella-free swine. Fifteen sows aborted or gave birth to dead pigs within a two-month period and serological studies revealed ascending titers to *L. pomona* in several pigs. Serological studies of animals in the breeding herd and in the fattening lots revealed extensive leptospiral infection (tables 1, 2).

Since this herd comprised valuable bloodlines, control measures were directed toward elimination of the infection through the use of antibiotics, slaughtering only the less valuable animals. Therefore, the herd was divided roughly into two groups: one containing animals to be fattened and slaughtered as soon as possible; the other, the breeding herd, containing the animals with bloodlines which were to be preserved.

Fattening Group.—Blood samples were taken from these animals which were then assigned to groups on the basis of serum antibodies for *L. pomona* (table 1). In pen A, 28 pigs received no treatment and were sent to slaughter in two weeks. Their kidney tissues, collected at slaughter, when inoculated into 1-day-old chicks, resulted in isolations of leptospiras from 13 of the 28.

Pen B contained 23 pigs which were fed, free choice, with aurofac-10 to provide 200 mg. of aureomycin per pound of ground, well-mixed grain ration, for 14 days. After an additional 14 days, these animals were sent to slaughter irrespective of weight. No leptospiral organisms were isolated from kidney tissues.

Pen C contained 20 pigs which received polyotic intramuscularly at the rate of 3.0 mg. per pound of body weight each day for five days. When slaughtered, 14 days following the end of treatment, no leptospiras were isolated from their kidney tissues.

Breeding Group.—Of the 73 animals in the breeding herd, only 23 were selected as the nucleus for a new herd. They were chosen on the basis of bloodlines to be preserved, and not on the basis of serological reaction (table 2). There was an additional group of potential replacements to which animals were added from time to time. The original 23 adults and the potential replacements received the aurofac-10 treatment for 14 days.

Three months following completion of this treatment, blood samples were taken from the 23 original animals and the 46 replacements to determine the presence of *L. pomona* antibodies. The 46 replacements were all negative but varying levels of antibodies were present in 7 of the original 23 swine (table 2). Urine was collected from the 7 and inoculated into 1-day-old chicks. Leptospiras were isolated from the

TABLE 2—Antibody Titers of Leptospira Pomona in a Swine-Breeding Herd, Before and After Treatment with Aureomycin

Animal (No.)	Pretreatment L. pomona titer	3 months post-treatment	8 mo. after initial treatment
51	1:10,000	1:100[1]	1:10
59		1:10[1]	Negative
88		1:100[1]	Dead
48	1:1,000	1:10[1]	Negative
54		1:100[1]	1:10
69		1:10[1]	Negative
72		Negative	Negative
73		Negative	Negative
75		Negative	Negative
80		Negative	Negative
45	1:100	Negative	Negative
49		Negative	Negative
50		Negative	Negative
68		Negative	Negative
74		Negative	Negative
87		Negative	Negative
Boar		1:1,000[1,2]	Negative
84	1:10	Negative	Negative
52, 70, 71, 78, 82	Negative	5 negative	5 negative

[1]Re-treated following three-month test—200 mg. per pound of feed for 14 days.
[2]Leptospiras isolated from urine.

urine of 1 boar which had a pretreatment titer of 1:100 and a three-month post-treatment titer of 1:1,000. All 7 reacting animals received another 14-day treatment with aurofac-10. The remainder of the herd was not treated because the infected boar was in isolation and was not being used for breeding.

Eight months following the original mass treatment of the breeding herd, blood samples were taken from 22 of the original animals and 62 replacements and tested for *L. pomona* antibodies. Again, all replacements were negative but 2 of the original pigs reacted at the 1:10 dilution. One of these had reacted at 1:10,000 in the original test and at 1:100 at three months post-treatment; the second pig, at 1:1,000 and 1:100. The boar from which organisms had been isolated was now negative. He was again tested about three months later, and no leptospiras were found by chick inoculation.

DISCUSSION

In this investigation, 1-day-old chicks were used for recovery of leptospiras from kidney tissue and urine of swine. Leptospiras were isolated from kidney tissues of untreated pigs, but not from those treated orally with aureomycin or parenterally with polyotic. Probably because of recent therapy, leptospiral organisms were suppressed to a point where the usual isolation technique would not show their presence. It is unlikely that residual antibiotic could have been responsible, since it has been shown[7] that no antibiotic could be detected in the serum and tissues of chicks and pigs when the antibiotic was withdrawn from the ration for one or two days. In the present study, antibiotic had been withdrawn 14 days before slaughter. One isolation of the organism was made from urine of 1 pig which had received oral treatment with aureomycin. The minimal infective dose for guinea pigs is reported to be 750 leptospiras,[4] but no such information is available for chicks. It has been shown[8] that hamsters are more susceptible to leptospiras than are chicks. Preliminary studies (to be published) on the use of day-old chicks for the isolation and cultivation of leptospiras have shown that they are a suitable medium for this purpose.

Control of leptospiral infection in a swine breeding herd may be determined by an over-all decline of circulating antibodies and the lack of antibody response in replacement animals. This serological herd check should be carried on over a considerable period of time.

One important point to be clarified in the epizootiology of leptospirosis is the frequency of occurrence of the organism in the kidney tubules of animals not having demonstrable titers to Leptospira. In *L. icterohaemorrhagiae* infection of rats, the presence of organisms in kidneys has been demonstrated without circulating antibodies. *Leptospira pomona* has been isolated[1] from a pig that had no leptospiral antibodies. Therapy with an antibiotic could eliminate leptospiras from the liver, spleen, and interstitial kidney tissues without completely sterilizing the kidney tubules, with the result that the animal might lose all indications of blood titer but remain a carrier.

SUMMARY

From 28 pigs showing antibody titers of *Leptospira pomona*, ranging from 1:100 to 1:10,000, 13 isolations of leptospiras were made from kidney tissues at slaughter. No leptospiras were recovered from kidney tissues of 20 fattening swine from the same herd which were treated with polyotic® intramuscularly (3 mg./lb.), daily for five days, or from 23 treated with aureomycin® at a level of 200 mg. per pound of feed, free-choice for 14 days.

Of 23 breeding swine, 18 showed pretreatment titers of 1:10 to 1:10,000 three months after treatment with aureomycin, 200 mg. per pound of feed for 14 days. Serological testing revealed antibody titers ranging from 1:10 to 1:1,000 in 7, and inoculation of urine from these into day-old chicks resulted in isolation of leptospiras from only 1. All reactors were re-treated. Eight months after the initial treatment, only 2 of the original 23 showed antibody titers. These had reacted at 1:10,000 and 1:1,000 before treatment, both at 1:100 three months later, and at 1:10 now. The animal with infective urine was negative eight and 11 months later.

On the basis of the results presented, it appears that polyotic and aureomycin are effective in suppressing *L. pomona* infection in swine.

References

[1]Burnstein, T., and Baker, J. A.: Leptospirosis in Swine Caused by *Leptospira Pomona*. J. Infect. Dis., *94*, (1954): 53-64.

[2]Brunner, K. T., and Meyer, K. F.: Streptomycin in the Treatment of Leptospira Carriers. Experiments with Hamsters and Dogs. Proc. Soc. Exptl. Biol. and Med., *70*, (1949): 450-452.

[3]Brunner, K. T., and Meyer, K. F.: Effect of Aureomycin on *Leptospira Canicola* and *Leptospira Icterohaemorrhagiae in vitro* and Experimental Carrier Studies. Am. J. Vet. Res., *11*, (1950): 89-90.

[4]Ringen, L. M., Bracken, F. K., Kenzy, S. G., and Gillespie, R. W. H.: Studies of Bovine Leptospirosis. I. Some Effects of Dihydrostreptomycin and Terramycin on the Carrier Condition in Bovine Leptospirosis. J.A.V.M.A., *126*, (1955): 272-276.

[5]Bryan, H. S.: Studies on Leptospirosis in Domestic Animals. V: Experimental Antibiotic Therapy in Chronic Bovine Leptospirosis. Vet. Med., *50*, (1955): 349-352.

[6]Howarth, J. A.: A. Macroscopic Tube-Agglutination Test for Leptospirosis. To be published.

[7]Broquist, H. P., and Kohler, A. R.: Studies of the Antibiotic Potency in the Meat of Animals Fed Chlortetracycline. Antibiotics Ann., 1953-1954. Medical Encyclopedia, Inc., New York, N. Y. 1955.

[8]Byrne, R. J., Jahnes, W., and Gleiser, C. A.: Studies on Experimental Avian Leptospirosis. Cornell Vet., *45*, (1955): 290-296.

[9]Walch-Sorgdrager, B.: Leptospiroses. Bull. Health Organ., League of Nations (1939): 143-386.

Chemotherapy in Hamsters Chronically Infected with *Leptospira Canicola*

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The carrier state of the Leptospira-infected animal has become a problem of increasing importance. In animals infected with leptospiras, the organisms usually localize in the kidneys. They are eliminated in the urine of the carrier animals for a variable period. The transmission of the leptospiral disease to other animals, and to man, is through direct or indirect contact with the organism eliminated from carriers in this manner. Knowledge concerning the effective chemotherapy of the carrier animal would be of value in curbing the dissemination of this disease. For this reason, a number of commonly used chemotherapeutic agents were evaluated for their leptospirocidal effect in hamsters chronically infected with *Leptospira canicola*.

Brunner and Meyer[1,2] reported that streptomycin and aureomycin®, in contrast to penicillin, are effective in killing *L. canicola* organisms localized in the kidneys of infected hamsters and dogs.

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MATERIALS AND METHODS

Golden hamsters, 5 to 6 weeks of age, were inoculated intraperitoneally with 0.2 ml. of Schüffner's medium containing heavy growth of *L. canicola* (K9 No. 14). These hamsters were treated with an intramuscular injection of 500 I.U. of procaine penicillin G at 48 and 96 hours after inoculation. For use in this treatment, procaine penicillin G in oil with 2 per cent aluminum monostearate was diluted with sesame oil so that each 0.05 ml. was equal to 500 I.U. This procedure did not prevent localization of the leptospiras in the kidneys of infected hamsters, but it did prevent death of the hamsters during the acute phase of the disease.[1, 2]

At approximately three weeks postinoculation, the hamsters were separated, on the basis of weight, into groups and treatment was initiated. The route of administration, the treatment interval, and the course of treatment were dependent upon the particular agent tested. The agents for oral administration and intramuscular injection were diluted so that each dose was equal to 0.25 ml. and 0.05 ml., respectively.

One week following the completed course of treatment, the hamsters in all groups were destroyed for necropsy. The kidneys from the animals were macerated in saline solution and a suspension of the kidney was examined by dark-field microscopy for the presence of motile leptospiras. This dark-field microscopic examination was used to evaluate the effectiveness of the chemotherapeutic agents tested.

Histological sections of kidney tissue from chronically infected hamsters were stained with Levaditi's method.[9]

RESULTS

Sulfathiazole, sulfapyridine, sulfamethazine, and sulfaquinoxaline were ineffective in the treatment of the chronically infected hamsters. These drugs were administered orally up to dosages of 2,000 mg. per kilogram of body weight daily, two doses per day,* for three days

Bismuth arsphenamine sulfonate, sodium arsanilate, and phenothiazine, at the levels tested, were also ineffective in the treatment of this disease in hamsters. The maximum level of bismuth arsphenamine sulfonate tested was 25 mg. per kilogram, administered by two intramuscular injections at a 48-hour interval. Sodium arsanilate was administered orally in amounts which caused the death of the treated ani-

*See editorial comment at end of article.

mals with no therapeutic benefit. Phenothiazine administered orally for three days at a dosage of 2,000 mg. per kilogram daily had no effect on the leptospiral organisms in the kidneys of infected hamsters.

Procaine penicillin G was also used in treatment of the chronically infected animals. Penicillin administered by intramuscular injection at the rate of 500 and 5,000 I.U. daily for three days had no therapeutic benefit. At the 5,000-unit dosage level 4 of the 5 hamsters died from what appeared to be a penicillin toxicity.

The following agents were tested and appeared effective in killing Leptospira organisms localized in the kidneys of hamsters: dihydrostreptomycin, oxytetracycline, tetracycline, and erythromycin. Detailed information on the method of administration, dosage, and results are recorded (table 1). Dihydrostreptomycin was more effective at a lower treatment level than any of the other agents.

TABLE 1—Effect of Various Antibiotics on the Carrier State of Leptospira Canicola in Hamsters

No. of Hamsters	Treatment level (mg./kg./day)	Treatment interval (hr.)	Treatment duration (days)	Results** Pos.	Neg.
	Dihydrostreptomycin* administered i. m.†				
6	40.0	24	3	0	6
5	25.0	24	3	0	5
7	20.0	24	3	0	7
11	15.0	24	3	0	11
17	10.0	24	3	11	6
12	5.0	24	3	9	3
	Oxytetracycline* administered i.m.				
3	60.0	24	3	0	3
3	30.0	24	3	0	3
4	15.0	24	3	1	3
5	12.5	24	3	3	2
5	6.25	24	3	3	2
5	1.25	24	3	5	0
5	40.0	8	3	0	5
5	20.0	8	3	4	1
5	10.0	8	3	4	1
	Tetracycline* administered i.m.				
5	60.0	24	3	0	5
2	30.0	24	3	0	2
3	15.0	24	3	3	0
5	40.0	8	3	0	5
5	20.0	8	3	3	2
5	10.0	8	3	3	2
	Erythromycin* administered orally				
5	130.0	8	3	0	5
4	100.0	8	3	0	4
5	50.0	8	3	4	1
8	25.0	8	3	8	0
	Erythromycin* administered i.m.				
5	60.0	24	3	0	5
4	30.0	24	3	2	2
5	25.0	24	3	1	0‡
3	15.0	24	3	3	0
2	10.0	24	3	2	0
4	5.0	24	3	4	0

*Dihydrostreptomycin sulfate, Merck crystalline; oxytetracycline, Pfizer crystalline terramycin HCl; tetracycline, Lederle polyotic HCl crystalline; erythromycin—oral, Abbott oral pediatric erythrocin; erythromycin—i.m., Abbott erythrocin lactobionate.

†i.m. = administered intramuscularly.

**Positive, indicates that motile leptospiras were seen upon dark-field examination of kidney suspensions.

‡Four died from unknown causes.

Examination of the histological kidney sections (stained with Levaditi's method) which originated from infected untreated hamsters, revealed the localization of great masses of leptospiras in the lumen of the uriniferous tubules. More specifically, the localization appeared to be primarily in the proximal convoluted tubules. This assumption was made on the basis of the typical truncated pyramidal type of epithelium and the relatively small lumen size of the affected tubules.

Discussion

Our results indicate that the localization of the Leptospira organisms in the kidneys of hamsters occurs primarily in the lumen of the proximal convoluted tubule. In this location, the organisms are not only bathed with glomerular filtrate, which can provide them with suitable nutrients, but it is also one of the few locations in the body where they can apparently escape the presence of circulating antibodies. The latter statement, of course, assumes that in the normal nephron unit little, if any, protein antibody passes through the glomerulus. This information is also of importance in the selection of an effective chemotherapeutic agent for the treatment of this disease since any agent, if it is to be effective, must become a component of the glomerular urine in sufficient amounts to destroy the organism.

One reason for testing the sulfonamides was that these agents are excreted by the process of glomerular filtration and would, therefore, be expected to come in direct contact with the leptospiras localized in the lumen of the proximal convoluted tubules. Our *in vitro* work, which is not included in this report, with these sulfonamides revealed that they were not effective in killing leptospiras at what would be considered therapeutic levels. Both bismuth and arsenic compounds have been used effectively in the treatment of certain other spirochetal infections and both show a predilection for kidney tissue. In view of these facts, bismuth arsphenamine sulfonate and sodium arsanilate were selected for investigation. Phenothiazine was also

tested since, following absorption, it is broken down in the liver to leukothional, a bactericidal substance, which is excreted by the urinary system.[4]

The fact that penicillin is ineffective in the treatment of the chronically infected hamster may further substantiate the belief that this organism localizes in the proximal convoluted tubules of the kidneys of hamsters. Since 80 per cent of the circulating penicillin is excreted from the body by way of the distal portion of the urinary tubules,[4] this antibiotic may not be present in the glomerular filtrate in sufficient amounts to destroy the organisms.

SUMMARY

The localization of *Leptospira canicola* in the kidneys of hamsters appears to be primarily in the lumen of the proximal convoluted tubule. The significance of this finding is discussed.

The following agents were found ineffective in killing *L. canicola* localized in the kidneys of hamsters: sulfathiazole, sulfapyridine, sulfamethazine, sulfaquinoxaline, bismuth arsphenamine sulfonate, sodium arsanilate, phenothiazine, and penicillin. In contrast, the following agents were effective: dihydrostreptomycin, oxytetracycline, tetracycline, and erythromycin.

References

[1]Brunner, K. T., and Meyer, K. F.: Streptomycin in the Treatment of Leptospira Carriers. Proc. Soc. Exptl. Biol. and Med., *70*, (1949): 450-452.

[2]Brunner, K. T., and Meyer, K. F.: Effect of Aureomycin on *Leptospira Canicola* and *Leptospira Icterohaemorrhagiae — In Vitro* and Experimental Carrier Studies. Am. J. Vet. Res., *11*, (1950): 89-90.

[3]Mallory, F. B.: Pathological Techniques. W. B. Saunders Co., Philadelphia, 1938.

[4]Sollman, T.: A Manual of Pharmacology. 7th ed. W. B. Saunders Co., Philadelphia (1952): 562.

Editor's Comments

We wonder what would happen if large animals were given sulfonamides at this dosage rate, especially if they were affected with leptospirosis and presumably some nephrosis. At 2 Gm. per kilogram, or 2 lb./1,000 lb. twice daily, the dosage would be about 32 times the usual therapeutic rate.

When asked if sulfonamides seemed injurious to the kidney in hamsters with leptospirosis the authors replied:

The sulfonamides did not appear to be any more toxic—as judged by death—to the hamsters chronically infected with *Leptospira canicola* than the controls, although we did not make a special point of checking this. It is reasonable to believe that with certain types of nephritis—such as acute glomerulonephritis where there would be a decrease in urine output—sulfonamide crystallization in the kidneys would be more apt to occur. The hamsters in this study were suffering primarily with a chronic interstitial type of nephritis where polyuria, rather than oliguria, is present.

Crystallization of sulfonamides in the kidneys is apt to occur in oliguria. In acute leptospirosis in cattle showing hemoglobinuria, acute nephritis is present and we would expect oliguria. In other words, it is my impression, that the toxicity of sulfonamides in nephritis would, to some extent, depend upon the type of nephritis. Oliguria and an acid urine facilitate the formation of sulfonamide crystals in the kidneys.

We did observe toxicity, in the form of hematuria, in hamsters treated with sulfapyridine and sulfaquinoxaline. But this hematuria was observed both in the infected treated animals and in the noninfected treated (control) animals.

Intra-Articular Use of Cortisones.—Hydrocortisone acetate, used intra-articularly, may be of value in acute arthritis when the lameness is traumatic in origin and not due to faulty confirmation. Sound supportive measures must also be used. By relieving pain, the use of the joint is encouraged and atrophy is minimized. Successful treatment of acute inflammation of a hip or hock joint in 4 horses by the injection of 125 mg. of the drug is reported. *—C. S. Crane, D.V.M., Calif. Vet., June, 1956.*

Antibiotics for Use in the Eye.—Drugs are usually better absorbed by an inflamed than a noninflamed eye. Many drugs will not penetrate an intact cornea but almost all antibiotics will if the epithelium is abraded. Subconjunctival injections usually penetrate better than topical applications. Systemic administration is best if penetration of the posterior segments of the eye is desired.

For eye therapy, chloramphenicol is superior to other antibiotics regardless of the route of administration, penicillin is moderately effective, streptomycin is effective in high doses, and the tetracyclines penetrate poorly. For topical use, polymyxin, bacitracin, and neomycin are preferred.—*J.Am.M.A., July 7, 1956.*

Surgery and Obstetrics
and Problems of Breeding

Prostatic Abscess in the Dog

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South Orange, New Jersey

The occurrence of prostatic abscess in the dog, as evidenced from the literature, appears rare and is "difficult and often impossible to treat directly," according to Schlotthauer.[1] However, articles on radiographic diagnosis and surgical management of the canine prostate[2-5] indicate that such abscesses probably occur more commonly than realized. The successful treatment of a dog with a prostatic abscess, employing surgery combined with antibacterial chemotherapy, is, therefore, reported.

Case Report

On July 20, 1955, a 20-lb. mongrel Terrier, 9 years old, was presented for diagnosis because of anorexia, resentment of handling, markedly dejected attitude, and disinclination to move. The insertion of a rectal thermometer apparently caused excruciating pain. Rectal palpation revealed an enlarged prostate about 7 cm. in diameter, with a fluctuant point slightly to the right of the midline. Clinical findings were: temperature 105 F.; hemoglobin 12 Gm.; erythrocytes 6,400,000; leukocytes 23,000 with stab cells 25 per cent, neutrophils 71 per cent, lymphocytes 4 per cent; and nonprotein nitrogen, 41 mg./100 cc. of blood. The urine was amber and slightly cloudy, with a pH of 6.5 and a specific gravity of 1.025. It contained 4 plus albumin, no sugar, a few erythrocytes, a small number of pus cells, and many gram-negative bacilli. A scout film and a pneumocystogram confirmed the diagnosis of a markedly enlarged prostate (fig. 1 and 2).

Fig. 1—A film of the hindquarters of the Terrier (lateral view) delineating extent of prostatic enlargement.

Fig. 2—Pneumocystogram of the Terrier.

After four days' hospitalization, during which 25 mg. of furadantin®* was given *per os* three times daily and 250 cc. amigen 5 per cent (enzymic protein hydrolysate, Mead®) intravenously daily, the temperature dropped to 102.5 F.; therefore, the prostatic abscess was drained. Under pentobarbital sodium anesthesia, the left index finger was inserted to the point of greatest fluctuation, a sterile 10-cm. Lichtwicz antrum trocar with a 2-mm. lumen was inserted along the lower aspect of the left finger, through the rectal wall, and into the prostate (fig. 3), thereby releasing 150 cc. of a thick, purulent exudate. To facilitate elimination of the pus, the bladder was catheterized and inflated with 200 cc. of air.

The exudate, collected as aseptically as possible, when cultured† revealed the presence of *Escherichia coli*, *Proteus mirabilis*, and *Proteus vulgaris*. *In vitro* tests showed these organisms to be resistant to the three broad-spectrum antibiotics of the tetracycline group, to erythromycin, penicillin, streptomycin, and bacitracin; only moderately sensitive to polymyxin, but highly sensitive to furadantin and chloramphenicol.

The day after paracentesis, the temperature dropped to 100.4 F. and, for the first time in ten days, the animal ate voluntarily.

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*Brand of nitrofurantoin or N-(5-nitro-2-furfurylidene)-1-amino-hydantoin.

Grateful acknowledgement is made to Eaton Laboratories, Norwich, N. Y., for the supply of furadantin used in this study.

†The Clinical Laboratory, Lincoln Park, Newark, N. J.

Supportive therapy consisted of 4 mg. of stilbestrol intramuscularly once weekly to induce involution of the prostate gland, and 50 mg. of furadantin daily for six days. When discharged, a week after paracentesis, the temperature was normal and the urine was acid, had a specific gravity of 1.018, 2 plus albumin, contained a few pus cells and erythrocytes, and had an occasional hyaline cast. The prostate was barely palpable *per rectum*, and the patient no longer resented such handling.

A month later, the dog had gained 4 lb. and was in good condition. However, the urine still showed 1 plus albumin and a small number of pus cells, while many short, plump gram-negative rods were seen on microscopic examination of a stained smear of the sediment. The specific gravity was 1.024. The only medication was stilbestrol (4 mg.) injected intramuscularly weekly, since estrogen in small doses is believed to depress androgen secretion causing the prostate to atrophy.[6] The prostate returned to an apparently normal state. When examined a year later, the animal was in good health with no signs of recurrence.

DISCUSSION

In this animal, surgical drainage was made through the rectum because this approach afforded easy access to the point of greatest fluctuation. When the abscessed prostate projects into the abdomen and is not rectally palpable, the laparotomy approach[2] is indicated.

It is unfortunate that preoperative blood cultures and sensitivity studies on the causative organism were not made prior to the paracentesis; however, almost all cases of prostatitis in the dog are considered as nonspecific infections.[5a] Instead, a broad-spectrum antimicrobial agent was administered with the hope of lowering the invasiveness of the organism and rendering the patient a better operative risk. Fortunately, the sensitivity studies proved furadantin to be an excellent choice, specific against the organisms cultured from the exudate.

Furadantin is a synthetic antibacterial nitrofuran, highly effective on both gram-positive and gram-negative bacteria.[7] It is administered orally, excreted in the urine at a high concentration, and extensively used in human medicine in the treatment of genitourinary infections. While the successful use of this drug on acute and chronic prostatitis in man has been reported both in this country[8,9] and abroad,[10,11] we believe this to be the first published report of its use in canine prostatitis. Dogs generally tolerate well 2 to 4 mg. of the drug per pound of body weight.

Fig. 3—Pneumocystogram of the Terrier with trocar in prostate.

SUMMARY

Success in treating a prostatic abscess in a dog by paracentesis *per rectum*, followed by specific antibacterial treatment with furadantin, is reported.

References

[1]Schlotthauer, C. F.: The Prostate Gland in the Dog. Proc. Book, AVMA (1955): 239.
[2]Archibald, J., and Cawley, A. J.: Canine Prostatectomy. J.A.V.M.A., *128*, (1956): 173-177.
[3]Archibald, J., and Bishop, E J.: Radiographic Visualization of the Canine Prostate Gland. J.A.V.M.A., *128*, (1956): 337-342.
[4]Archibald, J.: Personal communication, April, 1956.
[5]Bloom, F.: Pathology of the Dog and Cat. American Veterinary Publications, Evanston, (1954): 295.
[5a]Bloom, F.: Pathology of the Dog and Cat. American Veterinary Publications, Evanston, (1954): 298.
[6]Bloom, F.: in Canine Medicine. American Veterinary Publications, Evanston, (1953): 553.
[7]Norfleet, C. M., Jr., Parker, R. B., and Carpenter, H. M.: Furadantin in Infections of the Genito-Urinary Tract. J. Urol., *70*, (1953): 113-116.
[8]Abrams, M., and Prophete, B.: Furadantin. Use in the Treatment of Urinary Tract Infections. Missouri Med., *51*, (1954): 280-282.
[9]Kaplan, J. H., and Hobgood, R.: Clinical Evaluation of Furadantin, a New Urinary Antiseptic. J. Urol., *72*, (1954): 549-551.
[10]Jensen, H. B., Lund, J., and Poulsen, P. E.: Furadantin, Et nyt kemoterapeutikum mod urinvejsinfektioner. Ugesk. laeger, *116*, (1954): 53-56.
[11]Schmidt, K. H.: Furadantin bei Harnwegsinfektionen. München. med. Wchnschr., *96*, (1954): 1516-1518.
[12]Bloom, F.: Personal communication, July, 1956.

Osteogenic Sarcoma of the Tibia in a Dog—Favorable Response Following Amputation

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Osteogenic sarcomas exhibiting rapid metastasis and fatal outcome have recently been reported.[1,2] This condition has also been adequately described.[3] The purpose of this report is to record one case in a dog that has remained well for more than a year after amputation of the affected part.

CASE REPORT

A male Boston Terrier, 4 years old, favoring its right hindleg, was first taken to a veterinarian in October, 1954. Examination revealed marked soreness in the area of the hock joint. It was considered as a possible strain or trauma and appropriate therapy was instituted. The dog continued to favor the leg, pain persisted, and in about three weeks a small circumscribed, firm enlargement appeared on the anterior surface of the distal extremity of the tibia. This protuberance continued to enlarge, the pain became more intense, and in the early part of December, 1954, the animal was referred to the writer for diagnosis. A radiograph suggested a tentative diagnosis of an osteosarcoma with an unfavorable prognosis. Both euthanasia and amputation of the affected leg were discussed with the owner.

The dog was returned on Jan. 3, 1955, with a request for an amputation. The initial blood examination prior to surgery revealed the following: hemoglobin, 16 Gm./100 cc.; r.b.c., 7.8 million per cubic millimeter; w.b.c. 6,360 per cubic millimeter; differential count within normal limits; and sedimentation rate, 32 mm./60 minutes.

Two days later, the affected leg was amputated at the stifle joint. The specimen, submitted to the Iowa Veterinary Diagnostic Laboratory, was diagnosed as an osteogenic sarcoma (fig. 1, 2).

Because a tourniquet and numerous ligatures were used during the operation, there was almost no loss of blood. (This is mentioned solely for the reason that the hemoglobin level continued to decline for a time following surgery.)

Postoperative treatment consisted of antibiotics and vitamins administered intramuscularly for seven days, and daily dressing of the stump wound. On Jan. 17, 1955, the hemoglobin was 12 Gm./100 ml. and the r.b.c. count was 6.8 million per cubic millimeter. Administration of one ferritrinsic* tablet, three times daily, was

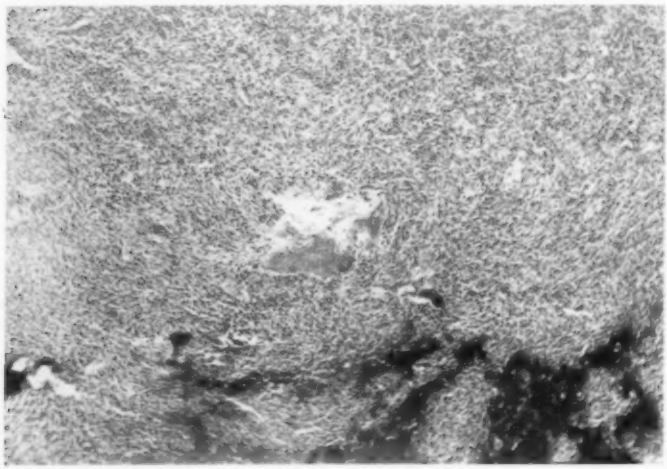

Fig. 1—Microphotograph of section of tumor tissue from a dog showing the arrangements of cells. Notice the presence of bone at the bottom of the photograph. Hematoxylin and eosin. x 100.

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The author expresses his appreciation to Dr. W. S. Monlux, Iowa Veterinary Medical Diagnostic Laboratory, Ames, for the tissue pathology work, and to Dr. Paul C. Bennett, supervisor of the laboratory, for preparation of the photomicrographs.

*Ferritrinsic (the Upjohn Co., Kalamazoo, Mich.).

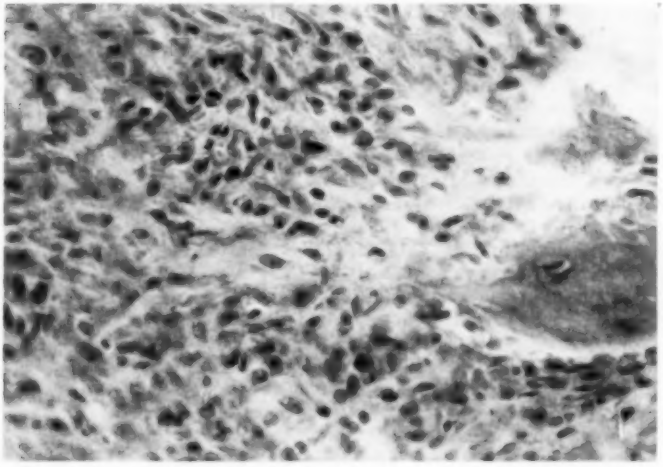

Fig. 2—High power of same section of tumor tissue as shown in figure 1. Note bone at right. x 450.

started and continued for three weeks. During this period, the animal remained alert, ate well, and lost only ½ lb. of weight. The dog was discharged the eighth day following surgery. Another blood examination made a week later revealed the hemoglobin to be 10.1 Gm./100 cc., but the sedimentation rate was reduced to 2 mm./60 minutes.

On Jan. 16, 1956, a little more than a year after the amputation, the dog was again examined and found to be in excellent health. At this time, a blood examination showed: hemoglobin, 19 Gm./100 cc.; r.b.c., 9,080,000 per cubic millimeter; w.b.c., 9,440 per cubic millimeter; differential count within normal limits; and the sedimentation rate, 1 mm./60 minutes.

CONCLUSION

No radiographs were taken of the lungs or abdominal organs, but it is believed that if metastasis had occurred, or was occurring, suggestive changes would have been noticed in the hemogram. Twelve months later, the dog was in excellent health; but it must be kept in mind, as suggested by the pathologist,[4] that metastasis of this type of neoplasm is often a slow process.

References

[3]Schnelle, Gerry B., and Meier, Hans: Metastasis of an Osteogenic Sarcoma After Amputation with Complications Including Splenic Lymphoma in a Dog. J.A.V.M.A., *126*, (1955): 451-456.

[3]Goodloe, L. O.: Osteogenic Sarcoma. North Am. Vet., *36*, (1955): 928-935.

[3]Lacroix, J. V., and Hoskins, H. Preston: Canine Surgery. 3rd ed. American Veterinary Publications, Inc., Evanston, 1952.

[4]Benbrook, E. A.: Personal communication.

Radioactive-Contaminated Wounds.—Treatment of wounds contaminated with radioactive material may involve the excision of otherwise viable tissues and the judicious intravenous use of zirconium citrate and edathamil calcium disodium to minimize the retention of potentially toxic radioelements.—*J.Am.M.A., May 12, 1956.*

Pantothenic Acid and Reproduction

An insufficiency of pantothenic acid may prevent reproduction. Gilts fed at levels of 1.5, 5.9, 12.5, and 19.1 mg. per kilogram of an otherwise adequate ration, showed signs of deficiency and none produced litters on the lowest level. At the other levels, there was no difference in the birth weights or number of pigs per litter, but pigs from gilts on the 5.9-mg. level developed incoordination, tremors, and intestinal bleeding shortly after birth. The milk from gilts on this level contained about half as much pantothenic acid as at the higher levels.

Gilts on the 1.5 mg. level developed a hemorrhagic diarrhea and "goose-stepping" after nine to 16 weeks. Several on the 5.9-mg. level developed spastic movements of the hindlegs. The 12.5-mg. level apparently was adequate.—*Nutr. Rev., May, 1956.*

Clinical Data

Acute Vegetative Endocarditis in the Dog and Cat

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A STUDY OF vegetative valvular endocarditis in dogs and cats, carried out at the Angell Memorial Animal Hospital, indicates that this is a condition of considerable importance, both clinically and pathologically. It also suggests that this disease-complex occurs more often in small animals than has been previously realized. Of 40 cases (27 dogs, 13 cats) thoroughly studied at necropsy, the diagnosis had been tentatively made before death in 15. It is probable that many more cases have gone unrecognized both in the hospital and in the outpatient clinic. It seems of value to focus attention on criteria for diagnosis and for proper treatment. This is possible only when the disease is recognized early in its development, and when the etiological factors, clinical course, and possible complications are understood.

On the basis of this study, it would appear that the syndrome resulting from vegetative valvular endocarditis is rather clear cut. Although the primary endocarditis may not always be clearly recognizable, the complications associated with embolism of the heart and arteries, parenchymatous organs, and skeletal muscle produce a characteristic clinical picture. An owner's history, the clinical examination, or a thorough search at necropsy usually provides a clue as to the site of focal infection. With regard to etiology and duration of the disease, as compared with the counterpart in man, it must be classified as *acute* vegetative valvular endocarditis.

SYNOPSIS OF THE DISEASE IN MAN

Valvular endocarditis of bacterial origin is a common disease in man and is characterized by the presence of septic thrombi (vegetations) on the valves of the heart. Its incidence depends somewhat on that of rheumatic heart disease, of which it usually is a complication.[1] The disease is termed acute or subacute depending on its duration, the subacute form being more common. The acute cases are almost always due to pyogenic organisms, the subacute cases to bacteria of relatively low virulence. In the majority of cases, the causative organisms in man are nonhemolytic streptococci of either the *alpha* (viridans) or *gamma* (anhemolyticus) variety. However, a great number of other microorganisms including staphylococci, corynebacteria, and Escherichia produce the disease.

Before the introduction of antibiotics, bacterial endocarditis was usually fatal. However, with the use of these drugs, particularly of penicillin and streptomycin, recoveries may be expected to three fourths of the patients in which the diagnosis is made early.

EXPERIMENTAL ENDOCARDITIS

Much uncertainty prevails as to the genesis of the disease in both man and animals. Endocarditis has been produced experimentally in dogs and rabbits by a great variety of procedures and bacterial organisms. The methods were usually of one of two types: (1) mechanical injury of the valvular endocardium with subsequent intravenous injection of virulent bacteria,[2] and (2) preliminary injection of predisposing substances followed by injection of organisms.[3]

Valvular injury or production of an "allergic state" by injection of foreign protein was claimed to be a necessary prerequisite.[2-6] However, positive results have also been obtained simply by production of an infectious focus or by multiple or even single intravenous injections of bacteria in healthy animals.[7,8] It seems, therefore, that endocardial infection does not depend upon prior valvular damage[7,9]; however, it is probable that clumps of bacteria, not single ones, cause the infection.[2] Furthermore, the evidence suggests that endocarditis may develop under natural conditions after a focal infection or infectious disease of even short duration.[7]

As to the mechanism of valvular infection, it is currently believed to be due to direct bacterial implantation into the valves from the blood stream,[10] to bacterial embolism in valve capillaries,[11] or to valvular edema following myocarditis with secondary endothelial damage.[2,6]

In dogs, nonhemolytic (viridans) and hemolytic streptococci and *Aerobacter aerogenes* were successfully used to produce endocarditis. Pre-existing cardiac lesions, such as congenital defect or chronic valvular endocarditis, were stated to be predisposing to bacterial endocarditis.[8] In a group of dogs, 61 per cent developed endocarditis with repeated intravenous injections of bacteria isolated from focal infections in human beings, such as otitis media and pharyngitis.[9] Injections of susceptible dogs with hemolytic streptococci isolated from dogs with pneumonia produced bacterial endocarditis in 40 per cent of the attempts—many after one intravenous injection, others only after

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repeated injections.[10] From these experiments, it was concluded that virulent strains of bacteria isolated from the same species more easily produce disease than those isolated from another species (man).[10]

SPONTANEOUS VEGETATIVE VALVULAR ENDOCARDITIS IN ANIMALS

Reports of spontaneous endocarditis are scanty except in swine, in which vegetative valvular endocarditis is a well-known complication of erysipelas.

It is not uncommon in cattle following liver abscesses; some cases have possibly been related to three-day "stiff sickness."[12] Subacute bacterial endocarditis with pulmonary embolism associated with *Shigella equirulis* infection was found in a horse.[13] Observed in dogs more frequently than in large animals, it is usually secondary to pyemic and septicemic conditions.[14] Reports of 2 cases in dogs, with subsequent coronary embolism, were recently published. In 1 dog, all three aortic cusps were affected and in the other, one of the mitral valves[15] was affected. Arterial embolism, associated with a variety of heart lesions, has recently been described in 11 cats and was found to be an important cause of limb paralysis in this species.[16,17]

CASE REPORTS

Forty animals with endocarditis that came to necropsy at the Angell Memorial Animal Hospital constitute the material for this study. These have been summarized in tabular form (tables 1, 2).

CLINICAL FEATURES

The clinical data were recorded by various clinicians, and it is probable that many details were overlooked or omitted. In spite of these shortcomings, a clear picture of the syndrome emerged. The disease is characterized by signs of (1) infection, (2) embolism, and (3) cardiac impairment.

General Symptoms.—General symptoms result from septicemia. Fever, either remittent or sustained, is an almost constant feature. In 29 animals for which temperatures were recorded, 17 had temperatures of 103 F. or above. Many of the afebrile animals were near terminus. Extreme weakness, fatigability, depression, anorexia, and anemia resulted from fever and toxemia. If the causative organism is of the hemolytic type, excessive hemolysis may bring about anemia, icterus, and hemoglobinuria.

Because of the prominence of systemic or local manifestations, as with severe bronchopneumonia, pyometra, distemper, or leptospirosis, the endocarditis may appear merely incidental; however, it may be the immediate cause of death. A small local infection, such as an abscess or dental disease, may produce the clinical picture alone. Since a focal infection may have cleared up at the time of examination, an accurate case history is important. The owner may know of the animal having a tooth extracted or an abscess drained and this may suggest the diagnosis, since vegetative endocarditis often follows such surgical procedures.

Blood findings are of great significance. In most affected animals there was moderate or pronounced leukocytosis, with neutrophilia. Leukopenia, however, occurred in some instances of overwhelming septicemia. Differential counts often revealed a "shift to the left," with occurrence of young cells, such as myelocytes and even myeloblasts, in the peripheral blood. The sedimentation rate was usually accelerated. The platelets were normal in number, sometimes with giant forms. In 1 animal, severe thrombocytopenia resulted in hemorrhagic purpura. Blood cultures may supply a clue to the type of organism.

Vascular Symptoms.—Vascular symptoms resulting from peripheral embolism are significant for diagnosis. Embolism in 23 animals caused severe pain and shock. In 11 animals sudden leg tenderness, sagging gait, or intermittent paraplegia or paralysis followed partial or total occlusion of the posterior aorta, femoral, or brachial arteries. A "saddle" thrombus at the aortic bifurcation will cause pain, weakness, coldness, and loss of reflexes and pulsation, usually in both legs, in contrast to the unilateral effects of lodgement in an iliac or femoral artery. With complete occlusion of an artery, muscular atrophy occurs. One dog with a paralyzed and gangrenous limb, from a femoral occlusion of a month's duration, chewed the leg to shreds.

Sudden posterior weakness and lumbar tenderness were often caused by radiation of pain from renal infarcts. Such infarction was extremely frequent, causing albuminuria, cast formation, occasionally hematuria, and low specific gravity. Acute uremia developed in some cases, resulting in a misleading suggestion of leptospirosis. Embolism of the spleen occurred many

TABLE I—Clinical and Pathological Findings in 27 Dogs with Acute Vegetative Valvular Endocarditis

Breed, age, sex	Course	History	Clinical data	Laboratory data*	Necropsy findings	Possible primary focus of infection
(1) Shepherd 5 yr. male	Died 3 days after tumor removal.	Occasional bite wound and abscesses.	Temp. 103.8 F., active, alert.	None.	Inflamed roughened mitral valve, valvular and myocardial edema, acute and chronic pancreatitis.	Multiple wounds and abscesses.
(2) Collie 2 yr. male	Dead on arrival.	Sudden death preceded by attack of coughing and gagging.	None.	None.	A.V.E. (aortic V.); myocarditis, cardiac dilatation, suppurative pneumonia.	Distemper pneumonia.
(3) Spitz 6 yr. male	Died 4 days after splenectomy.	Laparotomy for "acute abdomen," bullet removed from lung 1 mo. before.	Persistent fever 103-105 F. (3 wk.), pain (upper abdomen).	w.b.c. 13,500, Hct. 38; sed. r. 45/30, 52/60.	A.V.E. (r. & l. AV valves); hypostatic pneumonia, pulmonary abscess.	Pulmonary abscess.
(4) Terrier 10 yr. male	Destroyed 1 day after entry.	Sudden posterior paralysis.	Temp. 103.5 F., paraplegia, lack of femoral pulses.	w.b.c. 18,700, Hct. 55, sed. r. 0/30, 0/60; urine: sp. gr. 1.011, alb. 2 +.	A.V.E. (mitral V.); focal myocarditis and nephritis, muscle infarct (thigh).	None determined.
(5) Terrier 8 yr. female	Died 1 day after tooth extraction.	Painful mastication, wt. loss, thirst, polyuria over long period.	Temp. 101 F., severe dental disease.	b.u.n. 45.5, creat. 4.0.	Healing vegetations (aortic V.); fibrinous epicarditis, chronic pancreatitis.	Dental disease.
(6) Setter 13 yr. male	Destroyed 2 days after entry.	Respiratory distress (2 days).	Emaciated, dehydrated, weak.	None.	A.V.E. (mitral V.); myocardial degeneration and edema, myocarditis, cardiac dilatation.	None determined.
(7) Setter 13 yr. male	Destroyed 2 days after entry.	Intermittent vomiting and wt. loss (1 mo.).	Heart bruit, pallor.	w.b.c. 19,300, Hb. 14, b.u.n. 28; urine: sp.gr. 1.013, alb. 2+.	A.V.E. (mitral V.); thrombosis (coronary A.); cardiac dilatation, pulmonary edema, focal nephritis.	None determined.
(8) Collie 14 yr. female	Destroyed 4 days after entry.	Anorexia, depression, thirst, polyuria, hindquarter weakness (3 days).	Temp. 104.3 F., heart bruit, pallor.	w.b.c. 34,500, Hb. 14, b.u.n. 17, creat. 2.1; urine: sp.gr. 1.035.	A.V.E. (r. AV valve); cardiac dilatation, liver abscess.	Liver abscess.
(9) Spitz 12 yr. female	Destroyed on entry.	Sudden r. rear paralysis, self mutilation.	Temp. 100.2 F., lack of r. fem. pulse, gangrene (r. rear musculature), heart bruit, dental disease.	None.	A.V.E. (mitral V.); thrombosis (r. fem. A.); gangrene (r. rear leg); focal nephritis.	Dental disease
(10) Boxer 2 yr. male	Died 1 day after entry.	Anorexia, temp. 103 F., tenderness of neck and brisket (1 mo. ago).	Temp. 105 F., heart bruit, hindleg lameness, depressed, uremic breath.	w.b.c. 74,000, Hct. 45, Hb. 15, sed.r. 2/30, 7/60, b.u.n. 73.5, creat. 1.6; urine: sp. gr. 1.015, alb. 3+.	A.V.E. (aortic V.); thrombosis (coronary, mesenteric A.); renal infarcts; gangrenous enteritis, peritonitis.	None determined.
(11) Terrier 7 yr. female	Destroyed (3 month's treatment unsuccessful).	Lethargy, pyrexia, wt. loss, and anorexia (3 mo.); under constant antibiotic treatment.	Temp. 104.8 F., pallor, pharyngitis, weak, depressed, emaciated.	Dec. 30: w.b.c. 4,300; Jan. 21: w.b.c. 16,300, Hb. 14.1, Hct. 41, sed.r. 2/30, 12/60, urine: sp. gr. 1.038, alb. 3+; Mar. 25: w.b.c. 6,050, b.u.n. 5.6.	Heart (not examined); thromboembolic foci (stomach musculature); acute gastritis, focal nephritis, hepatitis, pneumonitis.	Pharyngitis.
(12) Shepherd 8 yr. male	Died 6 days after entry.	Anorexia, thirst, weakness, fainting spells, and intermittent lameness of all legs (1 wk.).	Temp. 106 F., heart bruit, dyspnea, hindquarter weakness.	Mar. 21: w.b.c. 42,700, Hb. 16.1, sed.r. 1/30, 2/60, Hct. 47, b.u.n. 16.3, creat. 2; urine: sp. gr. 1.006, alb. 1+; Mar. 24: w.b.c. 59,300.	A.V.E. (r. & l. AV valves); myodegeneration, pulmonary and renal infarcts.	None determined.

TABLE I (Continued)—Clinical and Pathological Findings in 27 Dogs with Acute Vegetative Valvular Endocarditis

Breed, age, sex	Course	History	Clinical data	Laboratory data*	Necropsy findings	Possible primary focus of infection
(13) Collie 9 yr. female	Destroyed on entry.	Sudden paraplegia and hematuria.	Temp. 104.8 F., heart bruit, paraplegia, lack of femoral pulses, pallor.	w.b.c. 52,100, Hb. 13, sed.r. 20/30, 30/60, Hct. 25.	A.V.E. (mitral V.); thrombosis (aortic bifurcation); pulmonary and splenic infarcts; pulmonary edema.	None determined.
(14) Kerry Blue 9 yr. male	Died under anesthesia.	Prostatic abscess drained 3 wk.; now a fistula (inguinal region).	Temp. 102.2 F., bright, alert.	None.	A.V.E. (r. & aortic V.); acute prostatitis; acute bronchopneumonia.	Prostatitis.
(15) Beagle 6 yr. male	Died 5 days after entry.	Lethargy, anorexia, dyspnea, diarrhea, and hematuria (3 da.).	Temp. 103.6 F., anemia, icterus, dyspnea.	w.b.c. 13,800, Hct. 24, b.u.n. 19.2, creat. 0.4, sed.r. 3/30, 6/60; urine: sp. gr. 1.040, alb. 3+, bile 4+.	A.V.E. (r. AV); bronchopneumonia; icterus.	Bacterial pneumonia.
(16) Spitz 6 yr. female	Died 6 days after entry.	Whelped 1 week before (3 dead pups), anorexia, depression, thirst.	Temp. 104.6 F., hemorrhage, vaginal discharge, anemia.	w.b.c. 68,800.	A.V.E. (mitral & aortic V.); myocarditis, myocardial and valvular edema; acute bronchopneumonia, acute metritis.	Metritis.
(17) Boston Terrier 6 yr. male	Died 4 days after entry.	Anorexia, depression, and vomiting (3 days).	Temp. 101 F., icterus, coma, uremic breath.	w.b.c. 28,200, b.u.n. 186, creat. 5.2; Urine: sp. gr. 1.018, alb. 2+.	Valvulitis (mitral V.); myocardial hemorrhage; acute nephritis.	Leptospirosis.
(18) Chow 11 yr. male	Died 2 days after entry.	Anorexia, vomiting, weakness, thirst (1 wk.).	Ulcerative gingivitis, icterus, purulent nasal discharge.	None.	A.V.E. (mitral V.); valvulitis, renal and splenic infarcts, lymph node abscess.	Ulcerative gingivitis.
(19) English Setter 15 yr. female	Died 3 days after entry.	Urinary incontinence and eczema (1 yr.).	Temp. 103.2 F., heart bruit.	w.b.c. 42,000; urine: alb. 2+.	A.V.E. (mitral V.); acute valvulitis, renal infarcts (recent and healed).	None determined.
(20) Cocker Spaniel 12 yr. male	Died 1 day after entry.	Fainting spells, thirst, swelling of abdomen (6 mo.).	Temp. 104.4 F., ascites, gritty lung sounds.	None.	A.V.E. (mitral) V.); valvular and pulmonary edema, hydrothorax, hydropericardium, ascites, chronic nephritis.	None determined.
(21) Cocker Spaniel 12 yr. male	Died 9 days after entry.	Sudden onset of tarry stools and depression.	Temp. 103 F., (persistent) pallor, heart bruit, subc. hemorrhage, purulent alveolitis.	w.b.c. 47,000, 72,000, 100,000, 66,000 (marked neutrophilia with lack of platelets), sed.r. 3/30, 6/60.	A.V.E. (mitral V.); valvular edema, chronic nephritis, suppurative alveolitis.	Suppurative alveolitis.
(22) Cocker Spaniel 13 yr. male	Died 1 day after entry.	Coughing, lame, and depressed (2 wk.).	Temp. 101.2 F., dyspnea, pallor.	None.	A.V.E. (mitral V.).	None determined.
(23) Spitz 18 yr. female	Destroyed on entry.	Coughing, breathing difficulty (1 yr.).	Temp. 100.2 F., dry cough, heart bruit.	None.	A.V.E. (mitral V.); valvular edema.	None determined.
(24) Weimaraner 8 yr. male	Destroyed 15 days after entry.	Anorexia, thirst, depressed, vomiting, and diarrhea (2 da.).	Temp. 105 F., (persistent) edema of hindlegs (5 da. after entry), paralysis of l-ft foreleg (6 da. after entry).	Sep. 13: w.b.c. 20,000, sed.r. 0/30, 0/60; urine: sp. gr. 1.011, alb. 3+; Sep. 16: w.b.c. 47,000; Sep. 19: w.b.c. 53,000, sed.r. 7/30, 16/60; urine: sp. gr. 1.018, alb. 3+; Sep. 23; w.b.c. 80,000; urine: sp. gr. 1.013, alb. 3+.	Valvulitis (mitral V.); valvular edema, thrombosis (l. brachial A.); acute purulent prostatitis.	Acute purulent prostatitis.

TABLE I (Continued)—Clinical and Pathological Findings in 27 Dogs with Acute Vegetative Valvular Endocarditis

Breed, age, sex	Course	History	Clinical data	Laboratory data*	Necropsy findings	Possible primary focus of infection
(25) English Setter 13 yr. male	Destroyed 2 days after entry.	Slowly failing (1 mo.), vomiting.	Temp. 102.2 F., pallor, ascites.	w.b.c. 19,300; urine: sp. gr. 1.013, alb. 3+, bile 1+.	A.V.E. (mitral V.); focal nephritis, subacute pancreatitis.	None determined.
(26) Cocker Spaniel 5 yr. male	Destroyed 4 days after entry.	Intermittent lameness, anorexia, vomiting, wt. loss, and weakness of hindlegs (5 da.).	Temp. 100.8 F., heart bruit, pallor.	Oct. 15: w.b.c. 52,500, sed.r. 2/30, 36/60; urine: sp. gr. 1.012, alb. 1+; Oct. 17: w.b.c. 64,500.	A.V.E. (mitral V.); valvular and myocardial necrosis, focal nephritis.	None determined.
(27) Boxer 2 yr. male	Died 2 days after entry.	Dyspnea, vomiting (2 da.).	Temp. 103 F., dyspnea, pallor.	None.	A.V.E. (aortic V.); healed renal infarcts.	None determined.

*Hct. = hematocrit (%); sed. r. = sedimentation rate (mm./minutes); b.u.n. = blood urea nitrogen (mg./100 ml.); creat. = creatinin (mg./100 ml.); Hb. = hemoglobin (Gm./100 ml.); sp. gr. = specific gravity; alb. = albumen.

times, and the severe upper abdominal pain associated with it sometimes deceived the clinician into a diagnosis of acute necrotizing or chronic relapsing pancreatitis. In 1 dog, intestinal infarcts led to gangrenous enteritis, with rupture and peritonitis.

Cardiac Symptoms.—Cardiac symptoms were due to the endocardial vegetations. Heart sounds varied from slight irregularity of rhythm to definite harsh valvular murmurs. In some of the animals, perceptible heart bruits were not present on initial examination but developed during hospitalization. In others, harsh lung noises rendered heart sounds inaudible. Valvular stenosis and insufficiency caused cardiac hypertrophy, often with congestion and enlargement of the viscera. The bruits may be delayed but develop with the increase in size of the vegetation. Dyspnea resulted from passive congestion of the lungs, secondary to progressive heart failure, rather than from pulmonary embolism. Of 4 animals which succumbed after being anesthetized, none had shown previous symptoms and all were apparently compensating for their valvular lesions until anesthesia was given.

When a diagnosis of acute vegetative endocarditis is considered, certain criteria must be observed:

1) Previous or present infectious focus, or previous surgery, especially of a nonsterile type must be considered. However, it is often difficult to obtain an adequate history from an owner and, unless the clinician is personally acquainted with the past history of the animal, or an infectious focus is present at the time of examination, the site of origin of the endocardial infection can not be determined.

2) General symptoms of a severe infection with a prolonged febrile course, neutrophilic leukocytosis, and a rapid sedimentation rate must be noted. Acute vegetative endocarditis is frequently overlooked in a differential diagnosis when an animal exhibits symptoms of a generalized infection. When an animal has a primary focus of infection and an extensive endocardial lesion, the clinical signs are due to both conditions with the more extensive lesion dominating. However, if the primary lesion is extensive and the endocardial involvement only slight, the symptoms are probably related entirely to the primary lesion. If the primary lesion is slight or has disappeared, the endocarditis will dominate the picture.

3) The development of embolic phenomena will be obvious only when there is closure of a large vessel. Such complications usually occur late in the course of the disease and are indicated by paralysis, coldness of the limb, and lack of reflexes or arterial pulse. Embolism of the internal organs is difficult to diagnose unless acute vegetative endocarditis is recognized.

4) Heart bruits may not be present or may be heard in the early phases. They might possibly disappear after detachment of thrombus from the valve.

5) A positive blood culture will reveal the type of organism causing the endocarditis. An early diagnosis is important if effective measures are to be undertaken. Endocarditis should be considered in all animals with persistent or recurring fever and heart bruits.

The outlook for recovery decreases as treatment is delayed. At the Angell Memorial Animal Hospital, the combination of penicillin and streptomycin is most fre-

TABLE 2—Clinical and Pathological Findings in 13 Cats with Acute Vegetative Valvular Endocarditis

Breed, age, sex	Course	History	Clinical data	Laboratory data*	Necropsy findings	Possible primary focus of infection
(1) Tiger cat 6 yr. male	Destroyed 5 days after entry.	Used as blood donor (cardiac puncture); next day temp. rose to 103.6F., persisted until paralysis 5 days later.	Temp. 103.6 F., heart bruit, weak, depressed, lack of femoral pulse.	None.	Thrombosis (post. aorta); renal infarcts.	None determined.
(2) White cat 9 yr. male	Died 5 hours after entry.	Sudden posterior paralysis and dyspnea.	Paraplegia, lack of femoral pulses, dental disease.	None.	A.V.E. (mitral V.); myocarditis, myocardial and valvular edema, renal infarcts, thrombosis (aortic bifurcation); pulmonary edema.	Dental disease.
(3) Orange cat 3 yr., male	Died 2 days after entry.	Depressed, anorexia, diarrhea, and vomiting (5 da.).	Temp. 104.4 F., pallor, icterus, dehydrated, toe abscess.	w.b.c. 1,300 (overwhelming septicemia), Hb. 5.6.	Multiple thrombosis (mesenteric vessels, lymph node arteries); pseudomembranous enteritis. Gangrene (r. front toe).	Subcutaneous abscess.
(4) Cat 4 yr. male	Destroyed.	Extensive oral ulcerations (1 wk.)	Temp. 103.8 F., icterus, dehydrated.	w.b.c. 4,000 (overwhelming septicemia). Hb. 5.04, Hct. 7, ict. ind. 70.	A.V.E. (r. & l. AV valve); myodegeneration, pulmonary and renal infarcts, anemia, icterus.	Mouth ulcerations.
(5) Black cat 1 yr. male	Destroyed 10 days after entry.	Lameness, r. forleg (occurred 2 wk. before); at present lame on r. hindleg, lethargy, anorexia.	Temp. 105 F., anemia, icterus, pain (rt. hindleg), severe gingivitis.	w.b.c. 35,250.	A.V.E. (mitral & Aortic V.); myocarditis, myocardial and valvular edema, acute broncho-pneumonia.	Gingivitis.
(6) Tiger cat 5 yr. male	Died 1 day after entry.	Cough (2 wk.), anorexia, lethargy, weak, dyspnea.	Temp. 100.8 F., dyspnea, heart bruit.	None.	A.V.E. (mitral V.); acute pancarditis, coronary thrombosis, myocardial and renal infarcts, pulmonary edema.	None determined.
(7) Black cat 4 yr. male	Destroyed 1 day after entry.	Sudden, inco-ordination (1 da.).	Temp. 100 F., icterus, "acute abdomen," paralysis, (l. fore- and l. hindleg).	w.b.c. 21,000.	A.V.E. (mitral V.); myocarditis, pulmonary edema, splenitis, pancreatitis.	None determined.
(8) White cat 12 yr. male	Died 1 day after entry.	3 previous episodes of paralysis accompanied by cyanosis (recovered each time); posterior paralysis at present.	Temp. 100.2 F., heart bruit, paraplegia, lack of femoral pulses, severe dental disease, cyanotic.	None.	Thrombosis (l. atrium) (post. aorta); pancarditis; myodegeneration, renal infarcts.	Dental disease.
(9) Siamese 2 yr. female	Destroyed on entry.	Slowly failing since parturition (3 mo.).	Temp. 104 F., icterus, labial ulcerations, purulent vaginal discharge.	w.b.c. 2,150 (overwhelming septicemia), Hb. 8.8., Hct. 27, ict. ind. 60.	A.V.E. (aortic V.); suppurative metritis.	Metritis.
(10) Siamese 6 yr. female	Died 4 days after entry.	Sudden paralysis (r. rear leg).	Temp. 100 F., heart bruit, coldness and lack of reflexes (r. rear and r. foreleg); lack of r., femoral pulse.	w.b.c. 13,950, b.u.n. 105, creat. 4.8.	A.V.E. (mitral V.); myocardial and valvular edema, renal infarcts, thrombosis (post. aorta, r. brachial artery).	None determined.
(11) Black cat 9 yr. male	Died 3 hours after entry.	Sudden paralysis (r. foreleg), dyspnea, cyanosis.	Temp. 100.4 F., heart bruit, coldness (r. front limb).	None.	A.V.E. (l. & r. AV valves); myocarditis, valvular and pulmonary edema, thrombosis (r. brachial artery).	None determined.
(12) Persian 6 yr. female	Died 1 day after entry.	Inhalation pneumonia (5 mo. previous); recurrent dyspnea, anorexia.	Temp. 100.3 F., heart bruit, depression, grating lung sounds, ascites.	w.b.c. 15,750.	A.V.E. (mitral V.); valvulitis, purulent pneumonia, perihepatitis, splenitis, ascites.	Purulent pneumonia.
(13) Tiger cat 4 yr. male	Died 4 days after entry.	Sudden posterior paralysis.	Temp. 101 F., pallor, dyspnea, hindlimb coldness, lack of femoral pulses.	None.	A.V.E. (mitral V.); pancarditis, thrombosis (coronary artery and post. aorta); myocardial infarction.	None determined.

*Hb. = hemoglobin (Gm./100 ml.); Hct. = hematocrit (%); ict. ind. = icterus index (by color chart); creat. = creatinin (mg./100) ml.).

Fig. 1—Heart of cat with numerous fresh red vegetations involving the left atrioventricular valves (arrows).

quently used for treatment. Acute heart failure and embolization suggest an unfavorable prognosis. Prophylactic measures seem essential since many of the cases were associated with dental conditions. The teeth should be checked regularly. They should be cleaned and extracted when necessary. Penicillin and streptomycin should be given some hours before any nonsterile surgical procedure.

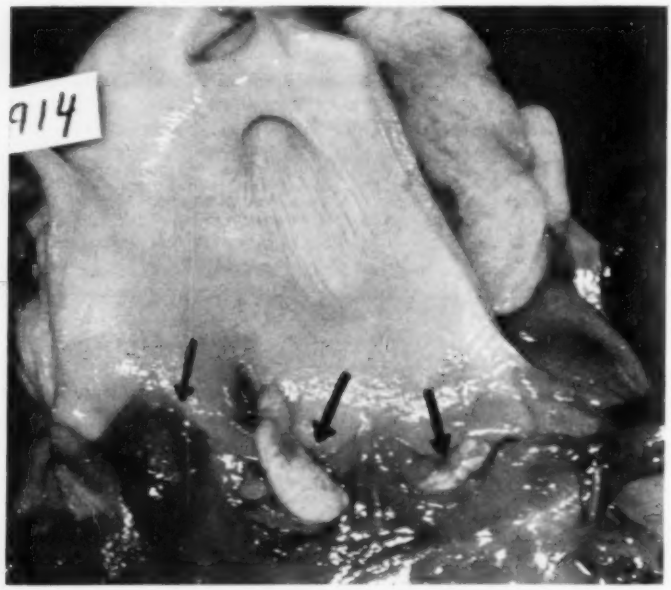

Fig. 2—Healing valvular vegetations at the aortic cusps of a dog (arrows).

PATHOLOGICAL FINDINGS

The fundamental feature is the presence of bacterial vegetations which may form cauliflower-like masses of variable size with broad bases and sometimes will considerably reduce the size of the valvular orifice (fig. 1). When vegetations are broken and detached, they may be overlooked when the heart is opened. They are usually red when newly formed, but become gray with time (fig. 2). The left atrioventricular valve, especially the septal leaf (fig. 3), and the aortic valve are most commonly involved. The valves are edematous and sometimes petechiated. The heart muscle at the base of the valves is often gray and spotted with hemorrhages. Subendocardial ecchymoses, especially at the site of the papillary muscles, and subepicardial petechiae may be seen.

Microscopically, in many cases, severe edema of the valves and endocardial damage are the only valvular lesions (fig. 4). In other instances, acute valvulitis is denoted by an accumulation of neutrophils. In some Giemsa-stained sections, bacteria can be seen (fig. 5). The myocardium usually reveals diffuse or focal cellular infiltration. Coronary thrombosis, miliary myocardial abscesses, focal necrosis, degeneration, and even dystrophic calcification are frequently seen. The myocarditis spreads, in some cases, to the pericardium and entire endocardium. A fibrinous epicarditis was found in one instance.

Widespread emboli (fig. 6) were found in 23 cases (14 dogs and 9 cats). The changes recognized histologically in various organs were more recent than those in the heart. The kidneys showed glomerular necrosis and simple or multiple infarcts in an acute hemorrhagic, purulent, or healing stage.

The parenchyma usually contains petechiae, particularly subcapsularly. Capsu-

Fig. 3—Vegetative valvular lesion of the left septal atrioventricular valve (arrows) in a dog with severe pericarditis, myocardial hemorrhages, and dystrophic calcification.

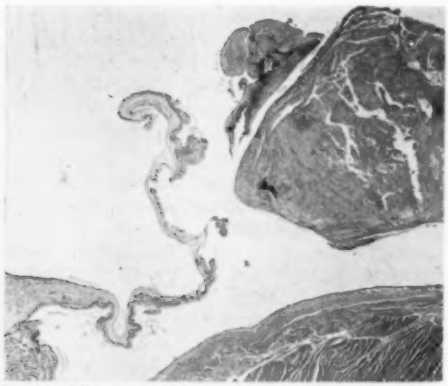

Fig. 4—Microscopic appearance of a valvular vegetation (slightly detached owing to cutting) in a dog. There is severe edema of valve and myocardium at the valvular base, endocardial damage, but there is no evidence of inflammation. Hematoxylin and eosin stain. x 50.

lar adhesions and pitting are apparent when the capsules are stripped. Healing infarcts are depressed, giving a bumpy appearance to the kidneys. The spleen is usually enlarged and may have irregular infarcts showing abscess-like suppuration on histological examination.

Obstructive emboli may be found at the site of the aortic bifurcation (so-called "saddle thrombi" fig. 7), and in the iliac, femoral, and brachial arteries (fig. 8). Infarcts of lung, intestine, and liver were observed in only 1 animal each. The viscera often appeared congested, owing to progressive heart failure. Since nervous symptoms were rare, the brain was seldom examined microscopically. Emboli in cerebral vessels were not detected.

ETIOLOGY

Vegetative endocarditis was associated with focal or systemic infections and was presumed to have resulted from pyemia and septicemia. Suspected primary conditions included subcutaneous abscesses, lacerations, bronchopneumonia secondary to distemper, dental lesions, throat infections, tonsilitis, mouth ulcerations, infected anal glands, prostatic abscesses, fistulas, metritis, vaginitis, traumatic arthritis, and traumatic pneumonia. In one instance, acute leptospirosis was the primary disease. It often followed surgical procedures, especially tooth extractions. Dental disease (suppurative alveolitis) and ulcerative mouth and throat infections were apparently the most frequent causes.

Hemolytic and nonhemolytic streptococci and staphylococci, *Pseudomonas aeruginosa*, and *Escherichia coli* were isolated from the primary infectious foci, valvular vegetations, heart blood, and blood stream.

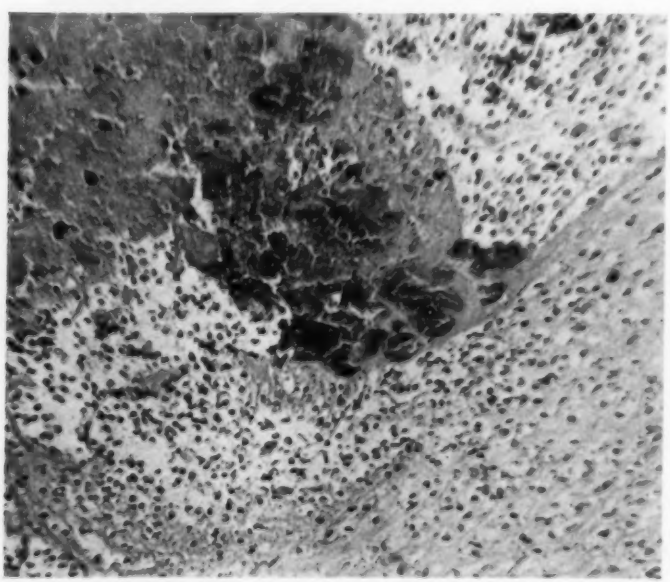

Fig. 5—Severe acute valvulitis with bacterial clumps (dark areas) in a dog. Giemsa's stain. x 200.

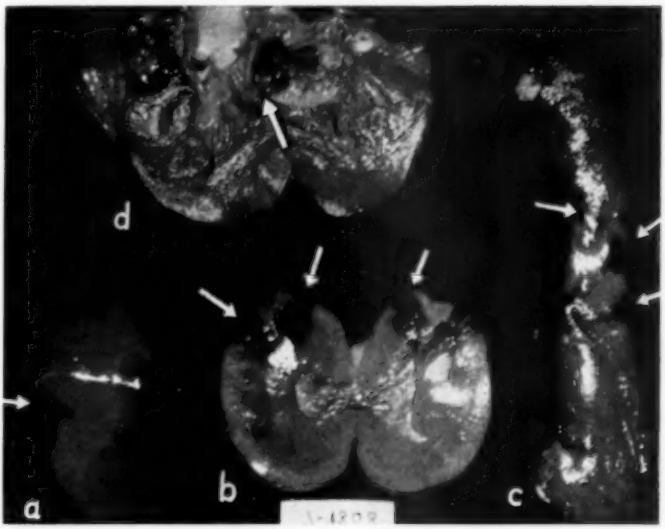

Fig. 6—Widespread embolism to (a) liver lobe, (b) kidneys, and (c) spleen (acute hemorrhagic infarcts) following thrombotic detachment from heart valves (d) of a cat.

COMMENT

When acute vegetative endocarditis is suspected, the immediate problem of treatment is the killing of all bacteria in the vegetation. This is difficult, since the tissue in which the bacteria are growing is poorly vascularized and the fibrin protects the bacteria from contact with the therapeutic agent.

Because of the bactericidal properties of the blood, relatively few organisms from either an active infectious focus or the valvular vegetations enter the blood stream and, since they may be present only intermittently, repeated blood cultures are necessary. Antibiotic treatment does not necessarily prevent the obtaining of culture growths because many commercial broths contain antibiotic-destroying enzymes. Especially made containers facilitate culturing.

The distinction between bacteriostatic and bactericidal action of drugs is important. Since bactericidal drugs are preferable, the combination of penicillin and streptomycin has been most highly recommended for man as erythromycin is not easily attained in the dosages commonly used. High antibiotic blood levels must be sustained long enough to assure killing of all bacteria and to prevent a recurrence.

As to pathology, it appears that the heart muscle is subject to focal and systemic infections in both dogs and cats, myocarditis often preceding the acute valvular lesion. Myocarditis at the base of the valves causes valvular edema, with swelling and bursting

Fig. 7—Saddle thrombus (arrow) at the site of the aortic bifurcation into the iliac arteries in a cat with sudden hindleg paralysis.

Fig. 8—Thrombosis (arrows) of the brachial artery of a dog suffering from prostatic abscess leading to acute vegetative valvular endocarditis and embolism.

of the covering endothelial layer. This denuded surface results in fibrinous deposition which forms an excellent medium for bacteria. Myocardial injury, with hemorrhages and inflammation, is commonly observed in leptospirosis and contagious hepatitis and could account for the development of endocarditis.

A second mechanism of infection observed in our material is a direct implantation of bacteria from the blood stream into the valves causing acute valvulitis. What injury or stress leads to bacterial infection and fibrin deposition is not clear (force of blood stream?). Such implantation also occurs in man and in experimental animals, usually after previous cardiac damage or defect. Indeed, rheumatic endocarditis exists in the majority of cases in man.

The indicated frequency of acute vegetative valvular endocarditis might explain the high incidence of chronic valvular disease seen at necropsy and recognized as the most common cause of cardiac insufficiency in dogs. The valvular puckerings and sacculations may represent the healed phase of the acute valvular disease. The frequent presence of recent and old infarcts in the kidneys suggests that an animal may survive acute vegetative valvular endocarditis and embolic complications. Furthermore, the focal disseminated nephritis which is often found at necropsy of dogs and cats could represent, in many instances, healing phases of prior infarctions from embolism.

CONCLUSIONS AND SUMMARY

Of about 600 necropsies on dogs and cats at the Angell Memorial Animal Hospital in less than a year, 40 (6.6%) revealed an acute vegetative valvular endocarditis, indicating that this condition is important clinically and pathologically. Vegetative endocarditis may be suggested by the following criteria: (1) the presence of local or systemic infection, or a history of nonsterile surgery (tooth extractions, abscess drainage, suture of contaminated wounds); (2) general signs of a severe infection with prolonged fever, neutrophilic leukocytosis, and a rapid sedimentation rate; (3) development of embolic phenomena (sudden lameness, pain); (4) heart bruits and cardiac weakness; and (5) positive blood culture (bacteremia). Features 2, 3, and 4 especially suggest a possible vegetative valvular endocarditis. Acute bacterial endocarditis occurred mainly secondary to active or latent local infections with pyogenic organisms.

The clinical picture may be dominated either by the primary disease, or by the secondary cardiac involvement and its complications. If the primary lesion is slight or has already healed, the endocarditis plays the chief role. The latter has been the immediate cause of death in all cases.

Prevention of the disease is important. This requires careful treatment of all focal infections and regular dental care. The probability that endocarditis may follow

treatment of infectious foci, especially tooth extractions, justifies the administration of antibiotics for some time before and after the operative procedure. Emboli must frequently enter the systemic circulation, since in the majority of instances vegetations are located on the mitral and aortic valves. Successful treatment depends on early diagnosis and intensive use of antibiotics. The treatment of cases with embolic phenomena is unsatisfactory and the prognosis is poor.

References

[1]Libman, E., and Friedberg, Charles K.: Subacute Bacterial Endocarditis. Oxford University Press, New York, N. Y., 1947.

[2]Kinsella, R., and Hayes, C.: Further Study of the Bacteremia of Experimental Streptococcus Endocarditis. Proc. Soc. Exptl. Biol. and Med., *24*, (1927): 887.

[3]Dietrich, W.: Ueber Anfänge der experimentellen Endokarditis. Virchows Arch. f. path. Anat., *299*, (1937): 285.

[4]Thomson, J. G.: Experimentelle Versuche ueber Endokarditis. Beitr. z. path. Anat. u. z. fuer. allg. Path., *95*, (1935): 316.

[5]Semsroth, K., and Koch, R.: Studies on the Pathogenesis of Bacterial Endocarditis. Arch. Path., *8*, (1929): 921.

[6]Foc, H.: Ein Beitrag zum Studium der experimentellen Endokarditis. Centralbl. f. allg. Path. u. path. Anat., *24*, (1913): 529.

[7]Detweiler, D. K.: The Heart in "Canine Medicine." American Veterinary Publications, Inc., Evanston, Ill., 1953.

[8]Detweiler, D. K.: Heart Disease in Dogs. Univ. of Pennsylvania Bull., Vet. Exten. Quart., Jan., 1952.

[9]Dick, G. F., and Schwartz, W. B.: Experimental Endocarditis in Dogs. Arch. Path., *42*, (1946): 159.

[10]Blahd, M., Frank, I., and Saphir, B.: Experimental Endocarditis in Dogs. Arch. Path., *27*, (1939): 423.

[11]Anderson, W. A. D.: Pathology. 2nd ed. C. V. Mosby Co., St. Louis, Mo., 1953.

[12]Brown, J. M. M.: Bacterial Endocarditis in Cattle—A Possible Sequel to Three-Day-Sickness. J. South Africa. Vet. M. A., *26*, (1955): 1, 29.

[13]Innes, J. R. M., Berger, J., and Francis, J.: Subacute Bacterial Endocarditis with Pulmonary Embolism in a Horse Associated with *Shigella Equirulis*. Brit. Vet. J., *106*, (1950): 245.

[14]Brumley, O. V.: A Textbook of the Diseases of the Small Domestic Animals. 4th ed. Lea and Febiger, Philadelphia, 1948.

[15]Nielsen, S. W., and Nielsen, L.: Coronary Embolism in Valvular Bacterial Endocarditis in Two Dogs. J.A.V.M.A., *125*, (1954): 376.

[16]Holzworth, J., Simpson, R., and Wind, A.: Aortic Thrombosis with Posterior Paralysis in the Cat. Cornell Vet., *45*, (1955): 468.

[17]Holzworth, J., Husted, P., and Wind, A.: Arterial Thrombosis and Thyroid Carcinoma in a Cat. Cornell Vet., *45*, (1955): 487.

Muscular Dystrophy in Sheep.—Muscular dystrophy occurred in Scotland in a group of 1-year-old ewes following exercise after four months of winter feeding on turnips. None of the wethers of the same age in a nearby lot, which had received a concentrate supplement, were affected. There was a similar occurrence, in 1947, after a severe winter. Turnips are low in vitamin E.—*Vet. Rec., June 30, 1956.*

Notes on Oxytocin

The oxytocic action of posterior pituitary extract was discovered nearly 50 years ago. It would stimulate contraction of an isolated uterus and would serve as a galactagogue. Later, the posterior pituitary secretion was found to contain two hormones—"pitocin" (or oxytocin) and "pitressin" (or vasopressin). Now oxytocin is being synthesized successfully.

Surprisingly, the oxytocin and vasopressin hormones are equally present in both sexes even though the physiological importance of neither agent concerns the male.—*Brit. Med. J., May 19, 1956.*

Renal Damage from Thorotrast.—Late damage, even fatal complications, may occur in organs capable of storing thorium dioxide. One human patient subjected to retrograde pyelography with thorotrast, in 1933, had intermittent attacks of severe pains in the region of the left kidney for two decades. When the nonfunctioning hydronephrotic kidney was removed, it contained 1.11 Gm. of thorium.—*J.Am.M.A., July 7, 1956.*

Stilbestrol and Growing Mink.—When 60 mink kits were fed a similar ration, except for stilbestrol added at various levels, there was no increased growth over controls and the kits fed high levels (10 μg./kit/-day) were significantly smaller than the others.—*Fur News, July, 1956.*

An antidote for heparin, an anticoagulant, has been announced. Called polybrene, it is given when the patient requires surgery while on a course of heparin to reduce the formation of thromboses.—*Sci. News Letter, July 14, 1956.*

Editorial

The Control of Leptospirosis

Since the announcement, in 1953, of *Leptospira pomona* vaccines, there has been a keen interest in, and considerable variance of opinion about, their value and the indications for their use. Therefore, the JOURNAL is pleased to present in this issue a number of articles pertaining to the use of vaccines and also to other phases of leptospirosis. The first article deals with the occurrence of the disease in cattle, the next three with the effectiveness of vaccination in naturally infected herds: one in cattle, one in ponies, and one in swine, the latter an experimental herd. Also presented are three reports on experimental attempts to free infected animals, particularly their kidneys, of Leptospira by chemotherapy.

With the consent of the authors, the comments of a qualified reviewer on the probable effects which vaccination had in the dairy and pony herds are added.

Because of the ubiquity, the "broad spectrum" infectivity, and the variability in the clinical effects of leptospirosis, differences in opinion regarding all phases of the disease are to be expected. Since the great majority of Leptospira infections seem to take a chronic and often a subclinical course, the results of attempts at control and therapy are difficult to evaluate.

Before sulfonamides and antibiotics became available, biological agents for almost any disease found ready acceptance because there often was no other protective agent to use. Since these biological agents often had little or no value, the practitioner who wished to mislead neither his clients nor himself usually had to evaluate them by leaving readily identified, unvaccinated controls in treated herds. The results were often definite. However, with a variable disease such as leptospirosis, the apparent results may be misleading.

We would like to direct attention to certain observations on bovine leptospirosis in the lead article, namely: (1) There were more reactors in recently infected herds (38%) than in herds with older infection (14%); (2) some animals seemed to retain antibodies indefinitely while others gradually became negative; (3) the titer usually was high at the time of abortion; (4) transmission was considerably affected by environmental conditions (subject to management control); (5) it was a relatively self-limiting disease; and (6) the disease probably could be avoided but not easily eliminated by test and quarantine measures.

More information is needed on the degree and longevity of serological reactions following vaccination, as well as following infection.

Valvular Endocarditis in Pets

Valvular endocarditis is a common disease of man and of swine (erysipelas), but in the dog and cat its prevalence is difficult to estimate due to the lack of records on complete necropsies. However, the reports of a few careful workers, such as Shouse and Meier (p. 278), who found it in 40 (6.6%) of 600 animals, suggest that it may be of significance as a cause of chronic illness and death in the dog and cat.

The rarity of arteriosclerosis in small animals has probably furthered the tendency to look elsewhere than the cardiovascular system for the cause of death.

The lesions of endocarditis are not prominent in small animals. However, it is not uncommon to find thickened heart valves. These are often accompanied by deep, broad-based scars (healed infarcts) on the surfaces of the kidneys, indicating that embolisms have occurred, presumably associated with the cardiac lesions.

The etiological factors are not specific but endocarditis usually follows chronic infections. It would seem to be a disease of mature animals as the average age, in the present report, is 8.9 years for dogs and 5.3 years for cats.

Of particular interest are the 5 cats with posterior paralysis in which emboli were found in the posterior aorta. Finding an embolus is not easy and requires an orderly necropsy. The antemortem diagnosis of an embolism is even more difficult.

This report should stimulate the performing of more complete necropsies, especially following a chronic, poorly defined illness. We hope it will also stimulate the recording, summarizing, and reporting of necropsy findings.

When obscure signs of illness challenge the imagination of the diagnostician, vegetative endocarditis, possibly accompanied by emboli, should be considered.

ABSTRACTS

Effects of Dietary Supplements on Weight Gains of Heifers

Three experiments were conducted on 36 Hereford heifers to determine the value of dietary trace minerals, the harmful effects of excess dietary calcium, and the comparative values of different roughages, such as alfalfa hay, prairie hay, and wheat straw, in promoting growth.

The addition of trace minerals to yearling beef cattle rations, adequately supplemented, had little effect on the growth rate. The trace minerals improved the coats and general appearances of the calves when a poor quality roughage, such as prairie hay, was fed. The prairie hay had been exposed to inclement weather after cutting.

Excess calcium with a calcium:phosphorus ratio of 10:1, with the phosphorus requirement being met, impaired the growth rate of the calves (significant at a 5% level).

Alfalfa hay fed at the rate of 1.5 to 2.0 lb. per head daily did not stimulate the growth rate of the calves on rations consisting of low quality roughages but adequate in protein, total digestible nutrients, calcium, phosphorus, and vitamin A. Alfalfa hay, like trace minerals, improved the general appearances of the calves; however, trace minerals were of little value in this respect when alfalfa hay was included in the rations.—[*Melvin J. Swenson, G. K. L. Underbjerg, and Dennis D. Goetsch: Effects of Dietary Trace Minerals, Excess Calcium, and Various Roughages on Weight Gains of Hereford Heifers. Am. J. Vet. Res., 17, (April, 1956): 207-212.*]

Resistance of Milk to Streptococcus as Affected by Feeding Silage

Milk samples were obtained from cows prior to and during the feeding of silage and were tested for resistance to acid production by *Streptococcus agalactiae*. This was accomplished by inoculating the samples with the Streptococcus and, following 24 hours of incubation, estimating the acid produced by titrating with 0:1 normal sodium hydroxide.

Resistance of the milk samples was lowered, for a few weeks, on addition of corn silage to a hay and grain ration which had been fed continuously for a year and a half. It was retained or improved slightly when cows which had been on pasture all summer were given forage-crop silage as part of their ration in the fall. A relatively good level of resistance was maintained during an eight-month observation period by milk samples from cows fed rations of forage-crop silage, alfalfa hay, and grain. Satisfactory levels also were maintained during a more limited period by samples from a few cows which were fed forage-crop silage as their sole or main source of forage.

The possibility was discussed that feeding programs of recent years, in which better quality and greater quantities of roughages have been stressed, may have helped reduce the incidence of *Str. agalactiae*.—[*W. D. Pounden, Norma A. Frank, R. W. Brown, and R. K. Scherer: The Resistance of Milk Samples to the Activity of Streptococcus Agalactiae as Affected by Feeding Silage. Am. J. Vet. Res., 17, (April, 1956): 231-234.*]

Infectious Atrophic Rhinitis

Since turbinate atrophy was first described in swine in 1830, many workers have attempted its transmission. In 1947, it was shown that the critical factor was the age of the inoculated pigs. With its successful transmission, there was a tendency to consider infectious atrophic rhinitis as a single specific disease.

In the course of the present work on etiology of turbinate atrophy, it was observed that a Selas No. 02 filter did not regularly allow passage of the agent(s) present in an experimental herd of infected swine. Therefore, Selas No. 015 filtrates were prepared and were found to contain the atrophy-producing agent(s). However, these filtrates often contained bacteria. When S. and S. cellulose ultrafilters of 0.5- to 0.75-μ average pore diameter were employed, atrophy-producing, bacteria-free filtrates could be produced.

The first field case investigated had the filter-passing agent(s) present but the next field case did not; it yielded *Pasteurella multocida* which was found to cause turbinate atrophy. From another herd an Alcaligenes sp. was recovered that produced turbinate atrophy.

Some lung specimens also contained a filter-passing agent(s) capable of causing turbinate atrophy. This agent(s) would withstand penicillin and thallium acetate at the usual levels but was sensitive to terramycin® in one trial. This agent was not *Mycoplasma hyorhinis* (the swine pleuropneumonia-like organism).

Repeated instillation of acetic acid would produce a severe rhinitis with resultant turbinate atrophy.

The finding that two unrelated bacteria, a filter-passing agents(s), and a chemical irritant would produce turbinate atrophy indicates that this lesion can not be considered a single specific disease. Additional information is needed to indicate if any one agent or group of agents is responsible for so-called "problem" field cases.—[*William P. Switzer: Studies on Infectious Atrophic Rhinitis. V. Concept that Several Agents May Cause Turbinate Atrophy. Am. J. Vet. Res., 17, (July, 1956):478-484.*]

Experimental Leptospirosis in Pregnant Swine

Leptospira pomona infection was established in 6 gilts by intravaginal instillation and in 9 gilts by conjunctival exposure. The first group was exposed immediately following breeding, in order to simulate the use of an infected boar, and all farrowed normal pigs. The latter group was exposed at various stages of pregnancy, and the 3 gilts infected during the second month failed to farrow

normally. All 15 gilts developed clinical signs of leptospirosis which varied from a mild febrile response to anorexia and obvious illness.

The authors concluded that the virulence of *L. pomona*, as measured by the severity of the acute phase of the disease, may not be closely associated with the abortifacient activity. The stage of pregnancy at the time of primary exposure to the organism is important in determining whether abortion or reproductive failure occurs.—[*L. C. Ferguson and T. E. Powers: Experimental Leptospirosis in Pregnant Swine. Am. J. Vet. Res., 17, (July, 1956): 471-477.*]

Relationship of Cobalt Deficiency to Parasites of Sheep

Sixteen lambs were weaned and placed on a cobalt-deficient diet within one week after birth. Upon the manifestation of cobalt-deficiency symptoms, they were separated into physiologically similar groups, of 4 animals each, for experimental feeding and parasite infection studies.

When compared at necropsy to lambs maintained on the basal ration only, those which received cobalt also had more *Haemonchus contortus*; more of the females of these parasites were gravid; at the same postinfection interval, a higher percentage of the females had linguiform processes (types 1 and 2); and the average length of these females was greater.

More cobalt was found in the worms recovered from the cobalt-fed lambs than from the lambs fed the basal ration only.

Based on these results, the ability of *H. contortus* larvae to establish themselves within the host animal appears to be dependent upon the presence of cobalt in the diet of the host animal.

Of the animals which died after receiving infective larvae, those maintained on the basal ration plus cobalt succumbed quicker but made better weight gains than those maintained on the basal ration only.—[*W. L. Threlkeld, N. O. Price, and W. N. Linkous: An Observation on the Relationship of Cobalt Deficiency to Internal Parasites of Sheep. Am. J. Vet. Res., 17, (April, 1956): 246-251.*]

Resistance of Lambs, Fed Minerals and Phenothiazine, to Nematodes

Lambs fed varying combinations of minerals and phenothiazine showed lower worm burdens from experimental and pasture infections. Those receiving trace minerals as the only supplement were more seriously affected—mortality was 80 per cent. This was probably due to the large number of eggs which contaminated the pasture. Addition of dicalcium phosphate to the trace minerals fed produced an added resistance, with no mortality.

More lambs receiving trace-mineralized salt passed worm eggs the first few weeks regardless of whether phenothiazine and dicalcium phosphate were included in the ration. A phenothiazine, trace mineral, and dicalcium phosphate mixture was superior to any of these alone or to other combinations of the three.—[*R. F. Shumard, R. J. Emerick, W. E. Bemrick, C. A. Herrick, A. L. Pope, and P. H. Phillips: Effects of Trace Minerals, Dicalcium Phosphate, Phenothiazine, and Combinations of These on the Resistance of Lambs to Haemonchus Contortus and Other Nematodes. Am. J. Vet. Res., 17, (April, 1956): 252-255.*]

Response of Chickens to Bronchitis Vaccines

A comparative study of seven infectious bronchitis vaccines was performed under strict isolation. Marked variations occurred in parentally immune and susceptible birds when different infectious bronchitis vaccines were used.

Incubation ranged from less than 24 hours to 15 days. The intensity of signs varied from mild to severe and the duration varied from eight to 32 days with the different vaccines. Variations, however, occurred with the same vaccine. The degree of immunogenicity varied considerably. Immunogenicity was not necessarily related to severity of signs in the experimental chickens.

All strains of infectious bronchitis virus tested, with the exception of the one administered intramuscularly, spread from the vaccinated birds to the susceptible exposure controls. Dissemination appeared to be unrelated to the length of incubation and the duration of signs in the principals. The incubation period was shorter in older than in younger birds, and the intensity of the vaccinal reactions was more pronounced in older birds. A more satisfactory immune response was obtained in birds 4 weeks old, or older, than in 1- to 5-day-old chicks.—[*Livio G. Raggi and Raymond A. Bankowski: Study of Some Commercially Available Infectious Bronchitis Vaccines. I. Response of Chickens to Seven Infectious Bronchitis Vaccines. Am. J. Vet. Res., 17, (July, 1956): 523-530.*]

New Canine Filariid Found

Microfilariae which are different from those of *Dirofilaria immitis* have been found in peripheral blood of dogs obtained from areas in Virginia, Maryland, Pennsylvania, and New Jersey. Comparison with *D. immitis* microfilariae after treatment with formalin and methylene blue indicates that they are shorter than the latter, 276.0 μ vs. 313.0 μ, and are considerably narrower, 4.6 μ vs. 6.9 μ. The tail of *D. immitis* microfilariae, under these conditions of treatment, was straight. In contrast, the tail of the unknown microfilariae characteristically terminated in a curved, buttonhook fashion. The locations of various anatomical structures, such as nerve ring and excretory cell, differ between the two microfilariae in Giemsa-stained thick films. The unknown species develops to infective-type, third-stage larvae in the body cavity of the fleas, *Ctenocephalides canis* and *Ctenocephalides felis*, but fails to develop in *Anopheles quadrimaculatus*. In the present study, the reverse was found for microfilariae of dogs shown at necropsy to contain *D. immitis*.

Thus far, with one exception, only light infections with this microfilariae have been encountered.

The size and its developments in fleas suggests that this microfilaria may be that of *Dipetalonema (Acanthocheilonema) reconditum* which is said to be a tissue filariid. Little information is available on the latter. Five adult filariids (1 male and 4 females) have been recovered from the subcutaneous tissues of a large female hound with the unknown microfilariae. No worms were found in the heart or pulmonary vessels. Only a single kind of microfilaria was observed, and a couple liberated into the fixing fluid by the females were similar to those occurring in the blood. The adult worms are relatively small; the female is about 32 mm. in length and 182 μ in width. The male, which has several caudal loops, measures approximately 17 mm. in length and 106 μ in width. Preliminary observations indicate that the parasite is a species of Dipetalonema. A complete description will be published later.

This is apparently the first demonstration that more than one canine filariid occurs in this country. This finding may shed light on some of the apparent discrepancies and unexplained findings reported for the canine heartworm.—[*Walter L. Newton and Willard H. Wright: The Occurrence of a Dog Filariid Other than Dirofilaria Immitis in the United States. J. Parasitol., 42, (June, 1956): 246-258.*]—CHARLIE N. BARRON.

BOOKS AND REPORTS

Blue Book of Awards

This is a compilation of major prizes, medals, honors, and distinctions, including significant scholarships and fellowships, open to citizens of the United States and Canada. It is indexed by donors and classified by fields. As pointed out in the preface, man has used awards in various forms as incentives or in recognition of outstanding performance since earliest times, e.g., crowns of laurel. The intrinsic value of an award does not necessarily measure its importance.

"Because awards, *per se*, search out those best qualified to receive them, the present compilation . . . serves as an authoritative, and objective guide to those men and women currently making the most noteworthy achievements in their chosen fields." This excerpt from the preface states quite well the nature of this useful reference volume.—[*The Blue Book of Awards. Edited by Herbert Brook. 1st ed. 186 pages, not including tables and index of donors. Published by Marquis-Who's Who, Chicago 11, Ill. Price $8.00.*]—J. G. HARDENBERGH.

Drug Encyclopedia

The fourth edition of the "Veterinary Drug Encyclopedia and Therapeutic Index" lists more than 2,000 drugs and biological products and gives a description of each, tells its action and uses, methods of administration, how the product is supplied, and the manufacturer who supplies it.

It also contains a therapeutic index and a manufacturers directory listing 87 manufacturers and their products.

This edition has been enlarged by over 100 pages and lists more than 500 products not included in the 1955 edition.

The book has proved a valuable reference for veterinarians and for students of veterinary pharmacology.—[*Veterinary Drug Encyclopedia and Therapeutic Index. 4th ed. Edited by Hadley C. Stephenson and Stanley G. Mittelstaedt. Drug Publications, Inc., New York, N. Y. 1956. Price not given.*]

Veterinary Surgical Techniques

This manual of surgical techniques combines two publications: "Surgical Course" by Pfeiffer and "Surgical Techniques" by Röder and Berge. The material is well arranged in eight chapters, with thorough discussions on all important surgical techniques in various species of large and small animals.

The first chapter deals with general principles of operative technique, including general and local anesthesia in horses, cattle, sheep, goats, pigs, dogs, and cats. The next two chapters describe operations on the head and the eyes.

The fourth chapter has been devoted to the most frequent operation performed on the equine neck—the "roaring" operation is described with the horse restrained on the table and under only a general anesthesia.

Further chapters deal with operative techniques on the thoracic and abdominal regions, the tail, genitourinary organs, and on the extremities.

The last chapter of the manual describes methods of casting and restraint of horses, cattle, pigs, and dogs.

This book has been written clearly and is supplemented with good illustrations. It would be a valuable addition to the library of veterinary practitioners as well as surgeons.—[*Veterinary Surgical Techniques (Tierärztliche Operationslehre). By E. Berge and M. Westhues. 27th ed. 375 pages, 264 illustrations. Paul Parey, Berlin and Hamburg, Germany, 1955. Price D.M. 29.60.*]—F. KRAL.

Preservation of Natural History Specimens

Step-by-step methods are described for the preservation of invertebrates and the arrangement and maintenance of collections. The many illustrations depict how to preserve, mount, and classify specimens, making the book valuable to the amateur naturalist as well as to the professional biologist. It also includes information on necessary materials and apparatus, reagents, labeling, storage, microscopy, and a detailed index.

A second volume on vertebrate botanical and geological material is in preparation.—[*The Preservation of Natural History Specimens. Vol. I. Invertebrates. By Reginald Wagstaffe and J. Havelock Fidler. 205 pages. 139 illustrations. Philosophical Library, Inc., New York, N. Y. 1955. Price $10.*]

THE NEWS

Position for Veterinarian in Korea

The Republic of Korea is interested in obtaining the services of a highly qualified veterinarian to establish and operate an experimental cattle farm in South Korea. The individual selected for the position must be familiar with all phases of animal husbandry and must be capable of operating independently. The salary for the position is $10,000 per annum or higher depending on the qualifications and capabilities of the individual. All expenses incident to transportation, shipment of household goods, and living costs will be borne by the Korean Government.

Applications should be addressed to: Mr. M. A. Pendergast, Suite 202, 1616 Eye Street, N. W., Washington 6, D. C. Applications should include a resumé of education and experience.

U. S. GOVERNMENT

Veterinarians Eligible for Public Health Service Traineeships.—The Surgeon General of the U. S. Public Health Service has announced a program of traineeships for graduate or specialized public health training for professional public health personnel. The program was authorized by the Health Amendments Act of 1956 recently passed by Congress.

Before adjournment, Congress appropriated funds to put the program into effect at once. It is designed to supplement, not replace, the training activities currently carried on by state and local health agencies.

Priority will be given to those who are newly entering public health work or who have been so employed for only a year or two. This should make the program attractive to young people who are interested in public health careers and who are just finishing their basic professional training.

With respect to veterinarians, only graduate or specialized public health training will be provided under the program—not basic professional preparation.

Information on the availability of traineeships, stipends, allowances, applications, etc., may be obtained from Dr. Jack C. Halderman, chief, Division of General Health Services, Public Health Service, Department of Health, Education, and Welfare, Atlanta, Ga.

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Veterinary Personnel Changes.—The following changes in the force of veterinarians employed by the U. S. Department of Agriculture are reported as of July 31, 1956.

TRANSFERS

Charles R. Adams, from Moultrie, Ga., to Quincy, Fla.
Arthur G. Beagle, from Portland, Ore., to Salem, Ore.
Robert N. Birdwhistell, from Fostoria, Ohio, to Fort Dodge, Iowa.
Ralph W. Boone, from Lansing, Mich., to Jefferson City, Mo.
Walter Burdio, from Worthington, Minn., to Nacogdoches, Texas.
Ralph Comin, from Dayton, Va., to Harrisonburg, Va.
Emery E. Coshow, from Frankfort, Ky., to Indianapolis, Ind.
Carl F. Davis, from Augusta, Maine, to Center Moriches, L.I., N.Y.
Josef Gac, from Pocomoke City, Md., to Salisbury, Md.
Hilborn H. Groat, from Denver, Colo., to Baker, Ore.
John Halij, from New Market, Va., to Winchester, Va.
Orville J. Halverson, from Portland, Ore., to Salem, Ore.
Francis L. D. Herchenroeder, from Washington, D.C., to Fort Worth, Texas.
William V. Hopkins, from Chicago, Ill., to Nashville, Tenn.
Thaddeus M. Howard, Jr., from Nacogdoches, Texas, to Jasper, Texas.
Daniel S. Jaquette, from Vineland, N.J., to Philadelphia, Pa.
Albert R. Kincaid, from Chicago, Ill., to Fayetteville, Ark.
Arthur J. Knilans, from Clover, S. Car., to Salisbury, Md.
Wolodymyr Kopacz, from Eastport, L.I., N.Y., to Otisville, N.Y.
Pransas Laptinskas, from Chicago, Ill., to Russellville, Ark.
Earl R. Mackery, from Atlanta, Ga., to San Juan, P.R.
J. Frank Mitchell, from Modesto, Calif., to Fontana, Calif.
Roy M. Morton, from Butterfield, Minn., to Worthington, Minn.
Gustav H. Mydland, from Ogdensburg, N.Y., to Topeka, Kan.
James C. Nowlen, from Chicago, Ill., to Hemlock, Mich.
Jordan E. Rasmussen, from Cheyenne, Wyo., to Salt Lake City, Utah.
Thomas N. Reid, from Waterloo, Iowa, to New York, N. Y.
Colin M. Robertson, from Harrisburg, Pa., to Ogdensburg, N. Y.
Edward C. Roukema, from Nashville, Tenn., to Atlanta, Ga.
Ernest E. Saulmon, from Baton Rouge, La., to Washington, D. C.
Arthur L. Smith, from Harrisonburg, Va., to Woodstock, Va.
William Wernet, from Cleveland, Ohio, to St. Paul, Minn.
Donald L. Williams, from Atlanta, Ga., to Baltimore, Md.
Leroy E. Williamson, from Harrisonburg, Va., to New Market, Va.
Gilbert H. Wise, from Lansing, Mich., to Baltimore, Md.

RETIREMENTS

Francis W. Beckman, Olympia, Wash.
James T. Brown, San Francisco, Calif.
Forrest R. Cameron, St. Paul, Minn.
Raymond F. Chase, Baker, Ore.
Joseph P. Mack, Atlanta, Ga.
Fred H. Sharp, Albuquerque, N. M.
Warren R. Sheff, Reno, Nev.
Simon D. Stovall, Sacramento, Calif.
Rollin M. Thomas, Fayetteville, Ark.

DEATHS

George A. Blohm, Silverton, Ore.
Bohdan Czechut, Omaha, Neb.
Bernard J. Lattimer, Worthington, Minn.
William E. Logan, Fort Worth, Texas.
Roy E. Patterson, Little Rock, Ark.

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Dr. Saulman to Assist in Disease Eradication Branch.—Dr. Ernest E. Saulmon (OSU '35) on June 17 became assistant to the chief of the U.S.D.A. Animal Disease Eradication Branch. Formerly stationed at Baton Rouge, La., he will serve as area director of livestock disease eradication in six northwestern states. His res-

ponsibilities include the training of field personnel and development of stand-by programs for control and eradication of foreign diseases of livestock.

COMMENCEMENTS

Michigan State University.—At the 1956 commencement exercises of the School of Veterinary Medicine, Michigan State University, the following 60 candidates were presented for the D.V.M. degree:

Thomas P. Anderson	Robert R. Birr
Atwood C. Asbury	Max D. Brand
Paul H. Beach	Robert S. Carter
Caroline E. Beitzel	Gerald C. Charteris
Roy W. Bellhorn	Richard D. Clark
Richard G. Benne	Rawland E. Clemens
Herman Berg	Thomas M. Clinton
Robert N. Berkman	Oral D. Corson
Richard E. Billings	Kenneth G. Cramton

Graduating Class, 1956, School of Veterinary Medicine, Michigan State University

Top row (left to right)—Thomas P. Anderson, Atwood C. Asbury, Paul H. Beach, Caroline E. Beitzel, Roy W. Bellhorn, Richard G. Benne, Herman Berg, Robert N. Berkman, Richard E. Billings, Robert R. Birr, Max D. Brand, Robert S. Carter.

Second row—Gerald C. Charteris, Richard D. Clark, Rawland E. Clemens, Thomas M. Clinton, Oral D. Corson, Kenneth G. Cramton.

Third row—Howard A. Dawson, Pierre DePorre, Kendric C. Douglas, Edward J. Drobish, Edward N. Eames, Robert W. Elkins, John W. Eppert, Dean E. Ewing.

Fourth row—John G. Gibson, Jewett B. Graves, F. Oral Grounds, Ralph W. Haase, Robert E. Harris, Dean C. F. Clark, Frank S. Hersom, Richard W. Huff, Steven A. Kudla, Richard H. Kurilchik, Ernest A. Liptak.

Fifth row—Clifford McClumpha, David K. Miller, Alex P. Murray, Edward K. Nakagawa, Glen E. Neidlinger, Charles O. Oldt, Paul J. Orloff, Harry H. Plymale, William B. Putnam, Manley F. Robinson, William F. Rooker, John F. G. Rooks.

Sixth row—William R. Ruff, George Sassu, Jack E. Sauer, David E. Shipman, Howard L. Tessman, Allan L. Trapp, Mirdza Udenans, Val C. Vangieson, William K. Wellman, Roger E. Wieland, Charles Wunderlich, Ivan Yanchyshyn.

Howard A. Dawson
Pierre L. DePorre
Kendric C. Douglas
Edward J. Drobish
Edward N. Eames
Robert W. Elkins
John W. Eppert
Dean E. Ewing
John G. Gibson
Jewett B. Graves
F. Oral Grounds
Ralph W. Haase
Robert E. Harris
Frank S. Hersom
Richard W. Huff
Steven A. Kudla
Richard H. Kurilchik
Ernest A. Liptak
Clifford McClumpha
David K. Miller
Alex P. Murray
Edward K. Nakagawa
Glen E. Neidlinger
Charles O. Oldt
Paul J. Orloff
Harry H. Plymale
William B. Putnam
Manley F. Robinson
William F. Rooker
John F. G. Rooks
William R. Ruff
George Sassu
Jack E. Sauer
David E. Shipman
Howard L. Tessman
Allan L. Trapp
Mirdza Udenans
Val C. Vangieson
William K. Wellman
Roger E. Wieland
Charles Wunderlich
Ivan Yanchyshyn

• • •

Tuskegee Institute.—At the 1956 commencement exercises of the School of Veterinary Medicine, Tuskegee Institute, Tuskegee Institute, Ala., the following 16 candidates were presented for the D.V.M. degree:

Raymond R. Adams, Jr.
James C. Allen
Raleigh H. Allen, Jr.
Harry T. Burleigh
Hubert L. Clay
Daniel D. Davis, Jr.
Marvin H. Downs
Jesse J. Featherstone
Welton D. Fillingames
Thomas L. Gibson
Ellis M. Hall
John H. Hall
Calvin E. Hubbard
A. Curtis Norris
Edward Pygatt
Darrell Roney

AMONG THE STATES AND PROVINCES

Iowa

State Association.—The annual sports and field day sponsored by the Iowa Veterinary Medical Association was held at the Mason City Golf Club, Mason City, on Aug. 2, 1956. Prizes were awarded and a dinner was enjoyed by all those who attended.

• • •

Annual Conference.—The annual veterinary conference for Iowa veterinarians was held on

Graduating Class, 1956, School of Veterinary Medicine, Tuskegee Institute

Top row (left to right)—Raymond R. Adams, Jr., James C. Allen, Raleigh H. Allen, Jr., Harry T. Burleigh, Hubert L. Clay, Daniel D. Davis, Jr., Marvin H. Downs.
Second row—Jesse J. Featherstone, Dean T. S. Williams, Welton D. Fillingames.
Third row—Thomas L. Gibson, Ellis M. Hall, John H. Hall, Calvin E. Hubbard, A. Curtis Norris, Edward Pygatt, Darrell Roney.

the Iowa State College campus in Ames on July 17-18, 1956.

The following were program participants: Richard Baum, Osage; G. W. Cornwell, Boone; Floyd Cross, president of the AVMA, Fort Collins, Colo.; E. Ingmand, Red Oak; C. D. Lee, Ames; George Mather, School of Veterinary Medicine, University of Minnesota, Minneapolis; C. Nelson, Jewell; C. Pfow, Mason City; Kenneth Smith, Sioux City; R. A. Tjalma, State University of Iowa, Iowa City; J. P. Torrey, ARS, U.S.D.A., Ames; and the following members of the I.S.C. faculty: John Bowne, John Collier, Joseph Graca, and R. A. Packer.

Kentucky

Officers of State Association.—At the forty-fifth annual meeting of the Kentucky Veterinary Medical Association, July 16-17, the following officers were elected: H. A. Gray, Bowling Green, president; V. L. Nickell, Winchester, first vice-president; H. H. Sutton, Lexington, second vice-president; Tom S. Maddox, Greenville, third vice-president; R. H. Singer, Lexington, secretary-treasurer; and E. L. Taylor, Georgetown, member of the executive committee.

s/T. J. STEARNS, *Resident Secretary.*

Massachusetts

Western Massachusetts Association.—The regular quarterly meeting of the Western Massachusetts Veterinary Medical Association was held on June 6, 1956, at the Lord Jeffrey Inn, Amherst. A panel discussion on laboratory services for practitioners followed the dinner. Members of the panel included laboratory workers from the University of Massachusetts and area practitioners.

s/STEWART K. HARVEY.

Michigan

Officers of Michigan State Veterinary Medical Association

Dr. Peter J. Babich, Flint (third from left), past-president of the Michigan Association, turns over his gavel to Dr. Kenneth Fraser, Niles, elected president at the Association's seventy-fourth annual meeting in Saginaw. Other new officers are (left to right) —Drs. Stephen R. Kelly, Detroit, president-elect; Charles H. Coy, Hillsdale, first vice-president; William Mackie, Lapeer, second vice-president; A. R. Wingerter, Big Rapids, third vice-president; and Paul Howard, Grand Rapids, secretary-treasurer.

North Carolina

Dr. Claude D. Grinnells Honored.—Dr. Claude D. Grinnells, professor of dairy husbandry at North Carolina State College, Raleigh, has been named by the North Carolina

Dr. Claude D. Grinnells

Veterinary Medical Association as honor veterinarian of the year. The award is based on outstanding service to the veterinary profession and to the livestock industry of the state. Dr. B. W. Dawsey, Gastonia, retiring president of the state Association, presented Dr. Grinnells with a plaque at the association's annual banquet.

Outstanding in his work with the livestock industry, Dr. Grinnells has served with the following organizations: American Dairy Science Association, southern section; Southern Animal Disease Research Workers; U. S. Regional Animal Disease Laboratory; and the North Carolina Veterinary Medical Association. Dr. Grinnells is a member of the AVMA Committee on History.

• • •

Redmont Association.—Newly elected officers for the Redmont Veterinary Medical Association are Donald Lackey, Lenoir, president, and J. L. Innes, West Asheville, secretary-treasurer. s/J. L. INNES, *Secretary.*

Texas

Dr. Schulz to Head Clinics Department.—Dr. Carl W. Schulz (KSC '34) has been appointed professor in charge of clinics at the School of Veterinary Medicine at the A. & M. College of Texas. Dr. Schulz's responsibilities will include direction of the large animal, small animal, and the ambulatory clinics.

For more than 18 years, Dr. Schulz operated

a general practice in Jefferson City, Mo. During his undergraduate years, he compiled a superior record including election to Phi Kappa Phi, a college-wide scholarship honor society. He served as a captain in the Army Veterinary

Dr. Carl W. Schulz

Corps during World War II and saw service in the China-Burma-India theater. He has appeared on numerous veterinary association programs and has contributed articles on clinical subjects to the veterinary literature.

The position to which Dr. Schulz has been appointed is one of ten new faculty and staff positions created this year at the Texas school in its current improvement program.

DEATHS

Charles P. Brady (KCV '13), 72, Pueblo, Colo, died June 24, 1956. Dr. Brady practiced for a short time, then served with the BAI, U. S. Department of Agriculture in Illinois, Texas, Oregon, North Dakota, Montana, and Nebraska, retiring in 1945 after more than 30 years with the Department. For the past two and one half years, he was meat inspector for the City-County Health Department in Pueblo. He was a member of the National Association of Federal Veterinarians and had been a member of the AVMA. His widow, two sons, and two granddaughters survive.

Bert Brunink (GR '18), McBain, Mich., died in 1955 or early 1956. Dr. Brunink was a general practitioner.

★**Otis H. Burnside** (API '42), 36, Franklin, N. Car., died May 1, 1956. Dr. Burnside, a general practitioner, was a member of the AVMA. His widow survives.

Bohdan Czechut (LEM '32), Omaha, Neb., died July 8, 1956. Dr. Czechut had been employed by the ARS, U. S. Department of Agriculture.

James C. Green (KCV '18), 72, Monticello, Ark., died in May, 1956. Dr. Green had served with the ARS, U. S. Department of Agriculture, for many years and had retired just a month before his death. He was a member of the National Association of Federal Veterinarians and had been a member of the AVMA. His widow survives.

★**Edward Himsel** (CIN '13), 66, Cincinnati, Ohio, died July 4, 1956. Dr. Himsel, who had served with the BAI, U. S. Department of Agriculture until his retirement in 1952, was a member of the National Association of Federal Veterinarians and a life member of the AVMA. His widow, two daughters, and four grandchildren survive.

A. H. Legenhausen (CVC '10), 68, Dundee, Ill., died April 9, 1956. Dr. Legenhausen had served for many years with the BAI, U. S. Department of Agriculture. He had been a member of the AVMA.

Floyd A. Logan (ONT '14), Marine City, Mich., died in 1955 or early 1956. Dr. Logan was a general practitioner and was also meat inspector for the St. Clair County Health Department until ill health forced his retirement.

Lee C. Songer (KCV '03), 78, Olathe, Kan., died May 21, 1956. Dr. Songer had served with the BAI, U. S. Department of Agriculture. He was a member of the National Association of Federal Veterinarians and had been a member of the AVMA.

★**Charles F. Van de Sand** (CVC '15), 73, Kiel, Wis., died March 8, 1956. Dr. Van de Sand had practiced in Kiel for 40 years, during which he served as president of the Wisconsin Veterinary Medical Association (1936), on the Wisconsin State Board of Veterinary Examiners (1931-1955 when he retired due to ill health), and as AVMA resident secretary (1924, 1930, 1931). He was admitted to the AVMA in 1917 and was made a life member in 1954.

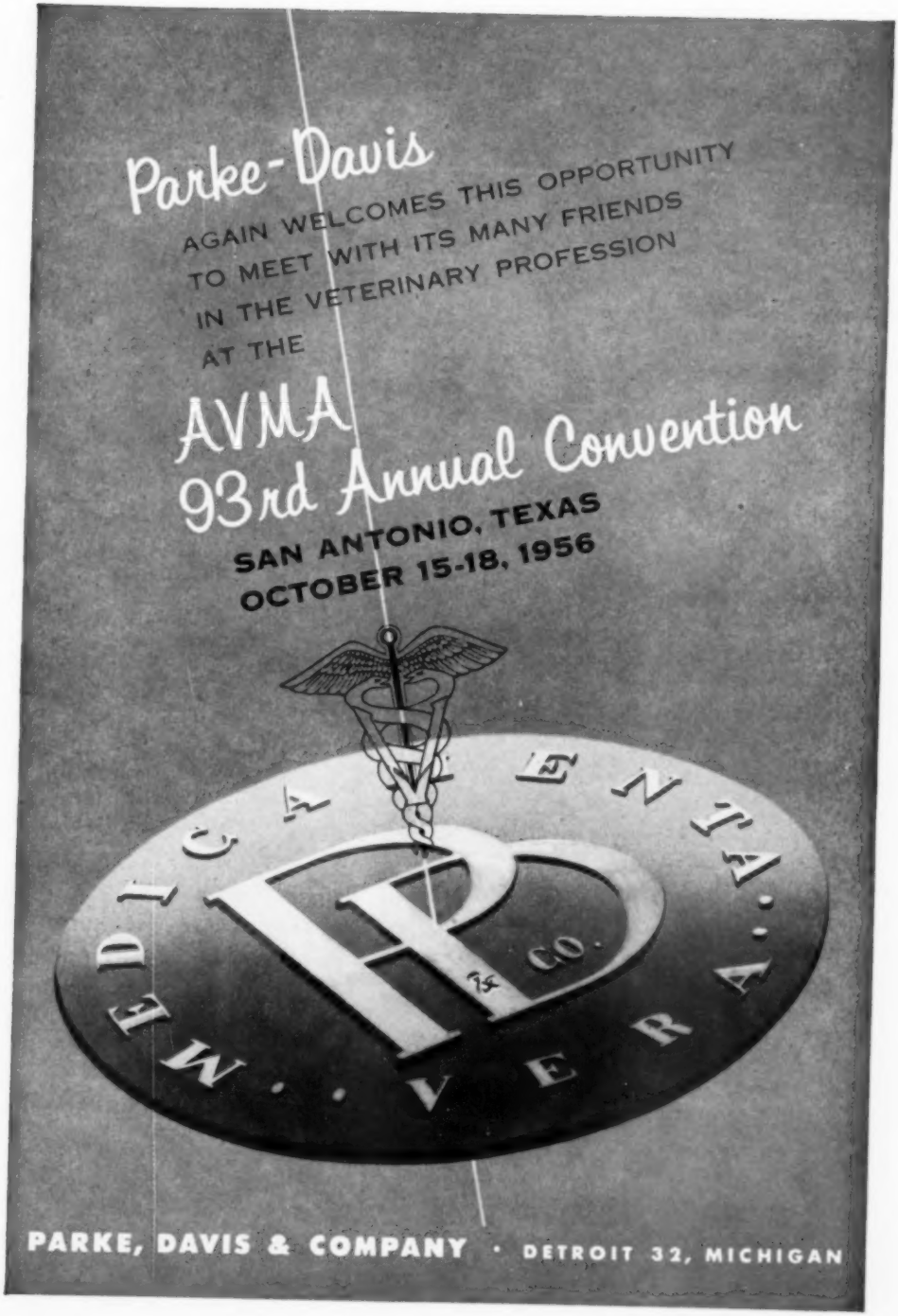
Dr. Van de Sand is survived by his widow, one son, and two grandchildren.

★**Leunis Van Es** (ONT '93), 87, Lincoln, Neb., died Aug. 27, 1956. An obituary will appear in the October 1 issue of the JOURNAL.

★**Arthur L. Warth** (WES '08), 74, Garnett, Kan., died April 24, 1956. Dr. Warth, a general practitioner, was a member of the Kansas Veterinary Medical Association and of the AVMA.

Perry Zenor (CVC '06), 74, Sioux City, Iowa, died June 4, 1956. Dr. Zenor had served with the BAI, U. S. Department of Agriculture for 40 years. He retired in 1951. He was a member of the National Association of Federal Veterinarians and had been a member of the AVMA. Dr. Zenor is survived by his widow, two sons, two daughters, and three grandchildren.

★Indicates members of the AVMA.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ORGANIZATION SECTION

Dr. J. M. Arburua and Dr. Dan J. Anderson Elected in Executive Board Districts VI and VIII

Dr. Arburua Reelected

In the balloting completed on July 10 in District VI (Arizona, California, Canal Zone and Central America, Colorado, Mexico, Nevada, New Mexico, Utah), Dr. Joseph M. Arburua, incumbent and present Board chairman, of San Francisco, was reelected for a five-year term ending in 1961.

Dr. Arburua, when first elected in 1951, was in active practice at the time. A graduate of San Francisco Veterinary College in 1915, he was associated for many years with Dr. John McInnes (SF '16) and, later, with Dr. McInnes and Dr. Milton C. Levy (WSC '31) in the operation of a practice and small animal hospital in San Francisco. Dr. Arburua has been active in veterinary

Dr. Joseph M. Arburua

affairs locally, in his state, and in the AVMA for a long time. In 1948, he was general chairman of the committee on local arrangements for the AVMA convention in San Francisco.

Especially interested in the history of the veterinary profession, he is the author of several articles on the subject and has been a member of the AVMA Committee on History for several years, serving as chairman in 1950. He served in the Army Veterinary Corps in both world wars, was active in the organized reserves following World War I, was recalled to active duty early in World War II, and was stationed at the Meat and Dairy Hygiene School in Chicago for a time and later at Fort Lewis, Washington.

Dr. Arburua retired from active practice about a year ago and is now living at 3020 26th Avenue, San Francisco.

New Member from District VIII

In District VIII (Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas), Dr. Dan J. Anderson, general practitioner of Smithfield, Texas, near Fort Worth, was elected to a five-year term succeeding Dr. W. G. Brock, Dallas, who has served on the Executive Board since 1946.

Dr. Anderson received his D.V.M. degree from Texas A. & M. College in 1928. He practiced first in San Antonio, was associated with the Ralston Purina Company in St. Louis for a time as animal pathologist, returned to Texas where he practiced at Terrill a short time before entering the Army Veterinary Corps, being discharged in 1945 with

Dr. Dan J. Anderson

the rank of captain; he is now a major in the Veterinary Corps Reserve.

Following release from military service, Dr. Anderson became state veterinarian with the Texas Livestock Sanitary Commission and so served until 1946 when he again entered practice. In 1954, he was named "Outstanding Practitioner" of Texas by the state association. He is past-secretary of the Tarrant County Veterinary Medical Society, a member of the Texas V.M.A. Executive Board, the U. S. Livestock Sanitary Association, veterinary advisor to the Southern Regional Education Board, and is active in community affairs in his home city.

Drs. E. R. Maschgan and Jo Anne Schmidt of Chicago served as tellers on July 12 and certified the results of the election in the two districts.

WOMEN'S AUXILIARY

Acting President—Mrs. Alfred E. Coombs, P.O. Box 174, Skowhegan, Maine
Secretary—Mrs. F. R. Booth, 3920 E. Jackson Blvd., Elkhart, Ind.

Kentucky Auxiliary.—The following officers of the Women's Auxiliary to the Kentucky Veterinary Medical Association have been elected for the coming year: Mrs. Harley Sutton, Lexington, president; Mrs. H. A. Gray, Bowling Green, first vice-president; Mrs. Nelson Potts, Glasgow, second vice-president; Mrs. Robert Folsom, Danville, secretary-treasurer; and Mrs. R. L. Hectorne, Louisville, publicity chairman.

s/T. J. Stearns, *Resident Secretary.*

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COMING MEETINGS

Central Indiana Veterinary Medical Association. Annual small animal seminar. Highland Country Club, Indianapolis, Sept. 19, 1956. George R. Burch, Pitman-Moore Co., Research Farm, R.R. 1, Box 504, New Augusta, Ind.

New York State Veterinary Medical Society, Annual meeting. Concord Hotel, Kiamesha Lake, N. Y., Sept. 19-21, 1956. L. W. Goodman, 2303 Northern Blvd., Manhasset, general chairman; Miss Joan S. Halat, 803 Varick St., Utica, secretary.

Washington State Veterinary Medical Association. Annual meeting. Davenport Hotel, Spokane, Sept. 21-22, 1956. P. J. Pfarr, 6306 N. Wall St., Spokane 53, general chairman.

Oklahoma conference for veterinarians. School of Veterinary Medicine, Oklahoma A. & M. College, Stillwater, Sept. 27-28, 1956. A. L. Malle, Department of Veterinary Pathology, chairman.

Missouri, University of. Annual short course for veterinarians. School of Veterinary Medicine, University of Missouri, Columbia, Oct. 1-2, 1956. Cecil Elder, chairman, short course committee.

Southwestern Iowa Veterinary Medical Association. Semiannual meeting. Chieftan Hotel, Council Bluffs, Iowa, Oct. 2, 1956. Fred W. Petersen, Avoca, secretary.

Purdue University. Annual short course for veterinarians. Purdue University, Lafayette, Ind., Oct. 3-5, 1956, L. M. Hutchings, Purdue University, Department of Veterinary Science, Lafayette, chairman.

Eastern Iowa Veterinary Association, Inc. Annual meeting. Hotel Montrose, Cedar Rapids, Oct. 4-5, 1956. Forrest E. Brutsman, Traer, secretary.

South Dakota Veterinary Medical Association. Annual meeting. Hotel Cataract, Sioux Falls, Oct. 4-5, 1956. J. L. Noordsy, Marion, S. Dak., secretary.

New England Veterinary Medical Association. Annual meeting. Hotel Statler, Hartford, Conn., Oct. 7-10, 1956. C. Lawrence Blakely, 484 Chestnut St., Needham, Mass., secretary.

University of Illinois. Annual Conference and extension short course for veterinarians. College of Veterinary Medicine, University of Illinois, Urbana, Oct. 12, 1956, L. E. Boley, Department of Veterinary Clinical Medicine, chairman.

American Association of Veterinary Bacteriologists. Annual meeting. Texas A. & M. College, College Station, Oct. 13, 1956. J. P. Delaphane, Michigan State University, College of Veterinary Medicine, chairman.

American Veterinary Medical Association. Annual meeting. Municipal Auditorium, San Antonio, Texas, Oct. 15-18, 1956. J. G. Hardenbergh, 600 S. Michigan Ave., Chicago 5, Ill., executive secretary.

Veterinary Symposium on Dogs. Kankakee Civic Auditorium, Kankakee, Ill., Oct. 24, 1956. Mr. Harry Miller, Gaines Dog Research Center, 250 Park Ave., New York 17, N. Y., director.

Mississippi Valley Veterinary Medical Association. Annual meeting. Hotel Pere Marquette, Peoria, Ill., Nov. 7-8, 1956. William L. Beer, 612 N. College Ave., Aledo, Ill., secretary.

Midwest Small Animal Association, annual meeting, and American Animal Hospital Association, regional meeting. Hotel Burlington, Burlington, Iowa, Nov. 18-19, 1956. J. Porter Coble, 2828 S. MacArthur Blvd., Springfield Ill., secretary, Midwest Small Animal Association.

U. S. Livestock Sanitary Association. Annual meeting. Morrison Hotel, Chicago, Ill., Nov. 28-30, 1956. R. A. Hendershott, 33 Oak Lane, Trenton 8, N. J., secretary.

Animal Care Panel. Annual meeting. Morrison Hotel, Chicago, Ill., Nov. 29-30, 1956. Robert J. Flynn, P.O. Box 299, Lemont, Ill., secretary.

Nebraska Veterinary Medical Association. Annual meeting. Hotel Lincoln, Lincoln, Dec. 3-5, 1956. W. T. Spencer, 1250 North 37th St., Lincoln, secretary.

New York State Veterinary College. Annual conference for veterinarians. New York State Veterinary College, Cornell University, Ithaca, Jan. 2-4, 1957, W. A. Hagan, dean.

Iowa Veterinary Medical Association. Annual meeting. Hotel Fort Des Moines, Iowa, Jan. 22-24, 1957. F. B. Young, Waukee, Iowa, secretary.

Minnesota State Veterinary Medical Association. Annual meeting. Radisson Hotel, Minneapolis, Feb. 4-6, 1957. B. S. Pomeroy, 1443 Raymond Ave., St. Paul 8, secretary.

Foreign Meetings

Asociación Médico Veterinaria de Puerto Rico. Inter American veterinary medical symposium. Caribe Hilton Hotel, San Juan, Nov. 30-Dec. 2, 1956. O. A. López-Pancheco, P.O. Box 155, Hato Rey, Puerto Rico, chairman.

(*Continued on p. 30*)

Bovine and Equine

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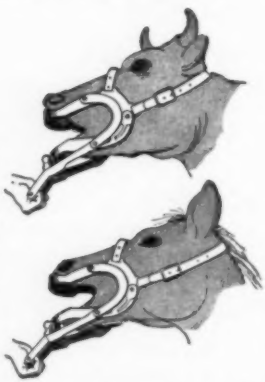

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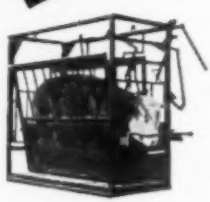

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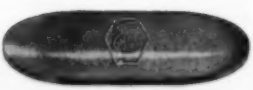

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(COMING MEETINGS—*continued from p. 28*)

Regularly Scheduled Meetings

ALABAMA—Central Alabama Veterinary Association, the first Thursday of each month. B. M. Lauderdale, Montgomery, secretary.

Jefferson County Veterinary Medical Association, the second Thursday of each month. S. A. Price, 213 N. 15th St., Birmingham, secretary.

ARIZONA—Central Arizona Veterinary Medical Association, the second Tuesday of each month. Keith T. Maddy, Phoenix, Ariz., secretary.

Pima County Veterinary Medical Association, the third Wednesday of each month in Tucson. E. T. Anderson, 8420 Tanque Verde Rd., Tucson, Ariz., secretary.

Southern Arizona Veterinary Medical Association, the third Wednesday of each month at 7:30 p.m. E. T. Anderson, Rt. 2, Box 697, Tucson, Ariz., secretary.

CALIFORNIA—Bay Counties Veterinary Medical Association, the second Tuesday of each month. E. Paul, Redwood City, Calif., secretary.

Central California Veterinary Medical Association, the fourth Tuesday of each month. Wilfred Pimentel, 3455 S. Elm Ave., Fresno, Calif., secretary.

Association of East Bay Veterinarians, bimonthly, the fourth Wednesday. Leo Goldston, 3793 Broadway, Oakland 11, Calif., secretary.

Kern County Veterinary Medical Association, the first Thursday evening of each month. A. L. Irwin, 301 Taft Highway, Bakersfield, Calif., secretary.

Mid-Coast Veterinary Medical Association, the first Thursday of every even month. W. H. Rockey, P. O. Box 121, San Luis Obispo, Calif., secretary.

Monterey Bay Area Veterinary Medical Association, the third Wednesday of each month. Lewis J. Campbell, 90 Corral de Tierra, Salinas, Calif., secretary.

North San Joaquin Valley Veterinary Medical Association, the fourth Wednesday of each month at the Hotel Covell, in Modesto, Calif. Lyle A. Baker, Turlock, Calif., secretary.

Orange Belt Veterinary Medical Association, the second Monday of each month. Chester A. Maeda, 766 E. Highland Ave., San Bernardino, Calif., secretary.

Orange County Veterinary Medical Association, the third Thursday of each month. Donald E. Lind, 2643 N. Main St., Santa Ana, Calif., secretary.

Peninsula Veterinary Medical Association, the third Monday of each month. T. D. Harris, San Mateo, Calif., secretary.

Redwood Empire Veterinary Medical Association, the third Thursday of each month. Robert E. Clark, Napa, Calif., secretary.

Sacramento Valley Veterinary Medical Association, the second Wednesday of each month. W. E. Steinmetz, 4227 Freeport Blvd., Sacramento, Calif., secretary.

San Diego County Veterinary Medical Association, the fourth Tuesday of each month. H. R. Rossoll, 1795 Moore St., San Diego, Calif., secretary.

San Fernando Valley Veterinary Medical Association, the second Friday of each month at the Casa Escobar Restaurant in Studio City. John Chudacoff, 7912 Sepulveda Blvd., Van Nuys, secretary.

Southern California Veterinary Medical Association, the last Wednesday of each month. Don Mahan, 1919 Wilshire Blvd., Los Angeles 57, Calif., executive secretary.

Tulare County Veterinarians, the second Thursday of each month. R. B. Barsaleau, 2333 E. Mineral King, Visalia, Calif., secretary.

COLORADO—Denver Area Veterinary Society, the fourth

(*Continued on p. 32*)

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NAME _____
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HILL PACKING COMPANY
P.O. Box 148 Topeka, Kans.

(COMING MEETINGS—*continued from p. 30*)

Tuesday of every month. Richard C. Tolley, 5060 S. Broadway St., Englewood, Colo., secretary.

Northern Colorado Veterinary Medical Society, the first Monday of each month. M. A. Hammarlund, School of Veterinary Medicine, Colorado A. & M. College, Fort Collins, Colo., secretary.

DELAWARE—New Castle County Veterinary Association, the first Tuesday of each month at 9:00 p.m. in the Hotel Rodney, Wilmington, Del. E. J. Hathaway, Clifton Park Manor, Apt. 73-5, Wilmington 2, Del., secretary.

FLORIDA—Central Florida Veterinary Medical Association, the second Friday of each month, time and place specified monthly. James B. Murphy, Eustis, Fla., secretary.

Jacksonville Veterinary Medical Association, the second Thursday of each month, time and place specified monthly. George F. Yopp, 4644 Main St., Jacksonville, Fla., secretary.

Palm Beach Veterinary Society, the last Thursday of each month in the county office building at 810 Datura St., West Palm Beach. Ross E. Evans, 5215 S. Dixie Highway, West Palm Beach, Fla., secretary.

Ridge Veterinary Medical Association, the fourth Thursday of each month in Bartow, Fla. Paul J. Myers, Winter Haven, Fla., secretary.

South Florida Veterinary Society, the third Tuesday of each month, at the Seven Seas Restaurant, Miami, Fla. E. D. Stoddard, 6432 S. W. 8th St., Miami, Fla., secretary.

Suwannee Valley Veterinary Association, the third Friday of each month, at the Thomas Hotel, Gainesville, Fla. R. C. Mann, Rt. 1, Box 37, Ocala, Fla., secretary.

GEORGIA—Atlanta Veterinary Society, the second Tuesday of every month at the Elks Home on Peachtree St., Atlanta, Ga. J. L. Christopher, Smyrna, Ga., secretary.

ILLINOIS—Chicago Veterinary Medical Association, the second Tuesday of each month. Mark E. Davenport, Jr., 215 S. Edgewood Ave., LaGrange, Ill., secretary.

Eastern Illinois Veterinary Medical Association, the first Thursday of March, June, September, and December. A one-day clinic is held in May. H. S. Bryan, College of Veterinary Medicine, University of Illinois, Urbana, secretary.

INDIANA—Central Indiana Veterinary Medical Association, the second Wednesday of each month. Peter Johnson, Jr., 4410 N. Keystone Ave., Indianapolis 5, secretary.

Michiana Veterinary Medical Association, the second Thursday of every month, except July and December, at the Hotel LaSalle, South Bend, Ind. J. M. Carter, 3421 S. Main St., Elkhart, Ind., secretary.

Tenth District Veterinary Medical Association the third Thursday of each month. W. E. Sharp, Union City, Ind., secretary.

IOWA—Cedar Valley Veterinary Association, the second Monday of each month, except January, July, August, and October, at Black's Tea Room, Waterloo, Iowa. H. V. Henderson, Reinbeck, Iowa, secretary.

Coon Valley Veterinary Association, the second Wednesday of each month, September through May, at the Bradford Hotel, Storm Lake, Iowa. D. I. Lee, Sac City, Iowa, secretary.

Fayette County Veterinary Association, the third Tuesday of each month, except in July and August, at Pa and Ma's Restaurant, West Union, Iowa. Donald E. Moore, Box 178, Decorah, Iowa, secretary.

Northeast Iowa-Southern Minnesota Veterinary Association, the first Tuesday of February, May, August, and November at the Winneslick Hotel, Decorah, Iowa, 6:30 p.m. Donald E. Moore, Box 178, Decorah, Iowa, secretary.

(*Continued on p. 34*)

Those moments when your work seems worthwhile...

"Thanks, Doctor...she sure had some swell puppies!"

The tears of gratitude in the eyes of a small boy when he thanks you for doing a good job . . . is there anything that quite measures up to this feeling?

Recommending a balanced diet supplying all the nourishment a dog can use is easy if you merely suggest Kasco Dog Food. Why Kasco? Because Kasco is a COMPLETE DIET for all dogs of all breeds.

KASCO FEATURES STABILIZED VITAMINS

Feeding Kasco correctly assures adequate daily amounts of vital vitamins needed especially during times of stress, such as pregnancy, nursing, accident or illness. Because Kasco's vitamins *are* stablized, full vitamin protection is a *fact* (not just fancy) in Kasco Dog Food.

This is just one of the many extras dog owners get when they feed Kasco Dog Food. The value of these "bonus benefits" shows up in a combination of top conditions and a lower feeding cost.

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KASCO® DOG FOOD

MANUFACTURED BY KASCO MILLS—TOLEDO, OHIO
A Division of Corn Products Sales Company

for good nutrition..

11 *essential vitamins*
9 *vital minerals*

IN BALANCE . . . .

VIONATE is a reliable source for all the vitamins and minerals known to be essential to the diet of dogs, cats, fur-bearing animals, horses and calves. Vionate is a *balanced* vitamin and mineral supplement — formulated to eliminate the need for partial supplementation, and to provide an adequate, balanced minimum daily intake of fat-soluble vitamins, B-complex vitamins, and essential minerals. Vionate is recommended for the prevention of all vitamin and mineral deficiency diseases, as well as for use therapeutically when deficiency symptoms are present.

VIONATE contains 11 VITAMINS, 9 MINERALS. Each of the vitamins and minerals in Vionate fulfills a specific need in growth, health, vigor, reproduction and general well-being. Vionate is particularly recommended for pregnant or lactating females to provide an abundant supply of bone-building calcium and phosphorus in the proper ratio, in addition to ample vitamin D to assure thorough assimilation. Vionate is important for weanlings and sucklings to provide the vitamins and minerals essential for fast growth, sound tooth and skeletal development, and for all fur-bearing animals to promote healthy skin and glossy shining coat.

. *prescribe* VIONATE®

recommended for

- Sound skeletal development in young
- Pregnant or lactating dams
- Prevention and treatment of deficiency diseases
- Maximum growth, health, vigor
- Healthy skin, glossy coat and fur
- Follow-up therapy after stress

VIONATE *contains*

VITAMINS	
Vitamin A	37,000 U.S.P. units per lb.
Vitamin D_3	3,700 U.S.P. units per lb.
Vitamin B_{12}	18 mg. per lb.
Vitamin B_2	36 mg. per lb.
Vitamin B_6	4.5 mg. per lb.
Vitamin B_{12} activity	0.07 mg. per lb.
Folic acid	1.8 mg. per lb.
Niacin	90 mg. per lb.
Pantothenic acid	45 mg. per lb.
Vitamin E	50 Int. Units per lb.
Choline	3,300 mg. per lb.

MINERALS	
Salt	6.6%
Calcium	7.7%
Phosphorus	4.6%
Iodine	.0018%
Iron	.044%
Cobalt	.00044%
Copper	.0044%
Magnesium	.066%
Manganese	.148%

feeding RECOMMENDATIONS

The vitamin and mineral content of most available foods varies greatly both in *quantity* and *ratio*. To assure an adequate daily supply of these essential food elements, the feeding of Vionate is recommended once each day from date of birth. Vionate added to total diet economically insures that *all* the vitamin and mineral requirements are met in proper balance.

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SQUIBB QUALITY

—THE PRICELESS INGREDIENT

We know meat. You know dogs. But we *both* know that protein is the key essential to a dog's good health. That's why *extra amounts* of meat protein go into Pard Meal . . . more than is found in any other leading dry dog food. It's first choice for flavor, too . . . dogs preferred it 2 to 1 in actual feeding tests. Because Pard Meal is so concentrated in complete food values, you can feed up to 25% less by volume. Now available in both flake and crumble textures—25- or 50-lb. bags.

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Swift
101ST YEAR

To Serve Your Family Better

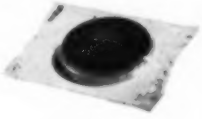
IT'S CONDENSED! FEED UP TO 25% LESS!

New Pard Meal is so rich in concentrated food value that, pail for pail, *you feed less* . . . up to 25% less than with other leading dry-type meals. Ask your Swift man to show you a comparative feeding chart.

SURE, SWIFT CANS PARD TOO

"Where's my Pard?" Dogs can't help clamoring for Swift's canned Pard . . . it's made with the GOOD BEEF TASTE that comes from juicy beef variety meats, ground beef bone and just the right amount of beef fat. There's as much nourishment in one can as there is in a *human* dinner of roast beef, green beans and mashed potatoes. Swift's Pard is all a dog needs or wants!

In the field...or in your clinic



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(prepared medium)

the disposable culture plate sealed in a sterile bag

9 MEDIA NOW AVAILABLE

for routine bacteriology

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- Chocolate Agar
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- MacConkey Agar
- S S Agar
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for routine mycology

- Sabouraud Dextrose Agar
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PRE-MEDS are optically clear, scratch-free Petri dishes containing *ready-to-streak* culture media. For maximum shelf life, each PRE-MED is sealed in a sterile polyethylene bag to preserve moisture and prevent air contamination. (Bag may be resealed for prolonged incubation.)

Gone are the tedious hours of preparing glass Petri dishes for re-use. Gone are the troubles that go with mixing your own culture media. Let Hyland do it for you—with modern, controlled, mass production methods. You get perfect, uniform, sterile preparations at what cost-conscious laboratories agree is actually less than "do-it-yourself" costs.

With PRE-MED, even perishable specimens become routine to handle. Simply open a bag, streak the plate, incubate—and after reading, destroy. Enjoy PRE-MED advantages now. In units of 3 plates of any one medium (minimum order) —50¢ per plate. Lower cost in quantity.

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KENTUCKY—Central Kentucky Veterinary Medical Association, the first Wednesday of each month. L. S. Shirrell, Versailles Rd., Frankfort, secretary.

Jefferson County Veterinary Society of Kentucky, Inc., the first Wednesday evening of each month in Louisville or within a radius of 50 miles. W. E. Bewley, P.O. Box "H," Crestwood, secretary.

MARYLAND—Baltimore City Veterinary Medical Association, the second Thursday of each month, September through May (except December), at 9:00 p.m. at the Park Plaza Hotel, Charles and Madison St., Baltimore, Md. Harry L. Schultz, Jr., 9011 Harford Rd., Baltimore, Md., secretary.

MICHIGAN—Mid-State Veterinary Medical Association, the fourth Thursday of each month with the exception of November and December. Robert E. Kader, 5034 Armstrong Rd., Lansing 17, Mich., secretary.

Saginaw Valley Veterinary Medical Association, the last Wednesday of each month. S. Correll, Rt. 1, Midland, Mich., secretary.

Southeastern Veterinary Medical Association, the fourth Wednesday of every month, September through May. Gilbert Meyer, 14003 E. Seven Mile Rd., Detroit 5, Mich., secretary.

MISSOURI—Greater St. Louis Veterinary Medical Association, the first Friday of the month (except July and August) at the Sheraton Hotel, Spring Ave. and Lindell Blvd. Allen B. Shopmaker, 136 N. Meramec, Clayton 5, Mo., secretary.

Kansas City Small Animal Hospital Association, the first Monday of each month, at alternating hospitals. W. F. Noland, 7504 Metcalf, Overland Park, Kan., secretary.

Kansas City Veterinary Medical Association, the third Tuesday of each month at Exchange Hall, ninth floor, Livestock Exchange Bldg., 1600 Genessee St., Kansas City, Mo. Busch Meredith, 800 Woodswether Rd., Kansas City 5, Mo., secretary.

NEW JERSEY—Central New Jersey Veterinary Medical Association, the second Thursday of November, January, March, and May at Old Hights Inn, Hightstown, N. J. David C. Tudor, Cranbury, N. J., secretary.

Metropolitan New Jersey Veterinary Medical Association, the third Wednesday evening of each month from October through April at the Academy of Medicine, 91 Lincoln Park South, Newark, N. J. Myron S. Arlein, 2172 Milburn Ave., Maplewood, N. J., secretary.

Northern New Jersey Veterinary Association, the fourth Tuesday of each month at the Casa Mana in Teaneck. James R. Tanzola, Upper Saddle River, secretary.

Southern New Jersey Veterinary Medical Association, the third Tuesday of each month at the Collingswood Veterinary Hospital, Collingswood. W. E. Snyder, E. Kings Highway and Munn Ave., Haddonfield, secretary.

NEW YORK—New York City, Inc., Veterinary Medical Association of, the first Wednesday of each month at the New York Academy of Sciences, 2 East 63rd St., New York City. C. E. DeCamp, 43 West 61st St., New York 23, N. Y., secretary.

Monroe County Veterinary Medical Association, the first Thursday of even-numbered months except August. Irwin Bircher, 50 University Ave., Rochester, N. Y., secretary.

NORTH CAROLINA—Central Carolina Veterinary Medical Association, the second Wednesday of each month at 7:00 p.m. in the O'Henry Hotel in Greensboro. J. W. Peace, High Point, secretary.

Eastern North Carolina Veterinary Medical Association, the first Friday of each month. Wm. Allen Potts, 401 W. James St., Mount Olive, secretary.

Piedmont Veterinary Medical Association, the last Friday of each month at 7:00 p.m. in Mull's Motel in Hickory.

(*Continued on p. 36*)

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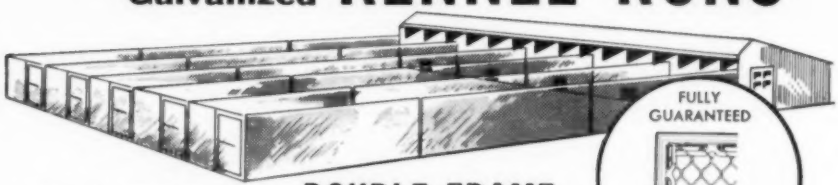
Trouble-Free Galvanized KENNEL RUNS



Featuring FORD'S *Exclusive* **DOUBLE FRAME CONSTRUCTION**

Nothing can match Ford Kennels for safety and long service. No tie wires to rust out, no dangerous sharp ends with Ford's *exclusive* patented double frame construction. Rust-resistant, galvanized chain link fabric is permanently locked to welded inner frame. In a versatile array of panels to meet every need—at easy-to-afford prices.

RED CEDAR SHAVINGS
in burlap bags
50 lb.—$4
100 lb.—$7
F.O.B. Indianapolis. No C.O.D.'s.

5 COMPARTMENT STALLS

Waterproof. Heavily galvanized sheets. 1½" angle iron frames braced and welded 1" pipe door frames with dog-proof mesh. Completely assembled. 2' and 3' interior stacking stalls also available. Satisfaction guaranteed.

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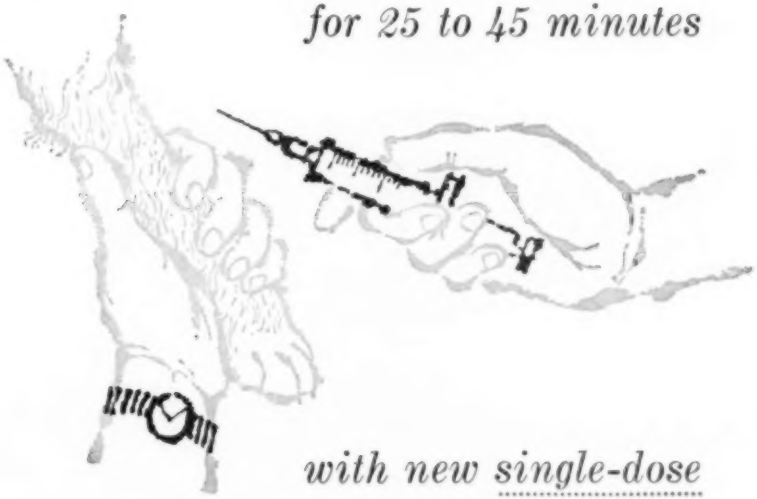
Ford
KENNEL EQUIPMENT

profound anesthesia

for 25 to 45 minutes



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COMBUTHAL®

(Pentothal® Sodium-Nembutal® Sodium)

just one intravenous injection

induces profound anesthesia in just 3½ to 5 minutes, even in excited animals. COMBUTHAL's wide safety margin includes surgical risk patients.

produces ideal surgical anesthesia

for 25 to 45 minutes, ample time for most surgical procedures. COMBUTHAL provides optimal skeletal muscle relaxation, permits additional doses for prolonged procedures.

with a quick, quiet recovery

usually in 30 to 60 minutes. Your patients awaken calmly from COMBUTHAL anesthesia, without excitement or disturbance to prejudice surgical results.

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®Pentothal—Thiopental, Abbott
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CBX222

Doctor, make your small animal work easier . . .

with a better light, a safer sterilizer

Whether it's a balky patient, awkward work area, or routine case—you want an operating light that focuses easily, and gives vision over a larger area even if animal moves.

Castle's new Veterinary Light swings through 355°—gives light from *any angle*. Offset Pantograph arm puts light directly over table; arm adjusts vertically within 24" range; lamp moves easily on caster base. (Wall and ceiling models also available.)

Color-correction makes diagnosis more accurate. Easy vision lessens fatigue.

Note the Castle "777" Speed-Clave. Safer, faster, easier than boiling, this autoclave destroys hepatitis virus, gives you added protection.

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My veterinary supply dealer is:_____

Castle LIGHTS AND STERILIZERS

(COMING MEETINGS—*continued from p. 34*)

N. Car. W. W. Dickson, Box 1071, Gastonia, N. Car., secretary.

Redmont Veterinary Medical Association, the last Tuesday of the month. J. L. Innes, 9 Tampa Ave., West Asheville, N. Car., secretary.

OHIO—Cuyahoga County Veterinary Medical Association, the first Wednesday of each month, September through May (except January), at 9:00 p.m. at the Carter Hotel, Cleveland, Ohio. Ed. R. Jacobs, 5522 Pearl Rd., Cleveland, Ohio, secretary.

OKLAHOMA—Oklahoma County Veterinary Medical Association, the second Wednesday of every month. James M. Brown, 2818 W. Britton Rd., Oklahoma City, secretary.

Tulsa Veterinary Medical Association, the third Thursday of each month in Directors' Parlor of the Brookside State Bank, Tulsa, Okla. Don L. Hohmann, 538 S. Madison St., Tulsa, Okla., secretary.

PENNSYLVANIA—Keystone Veterinary Medical Association, the fourth Wednesday of each month at the University of Pennsylvania School of Veterinary Medicine, 39th and Woodland Ave., Philadelphia 4, Pa. Raymond C. Snyder, 39th and Woodland Ave., Philadelphia 4, Pa., secretary.

SOUTH CAROLINA—Piedmont Veterinary Medical Association, the third Wednesday of each month at the Fairforest Hotel, Union, S. Car. Worth Lanier, York, S. Car., secretary.

TEXAS—Coastal Bend Veterinary Association, the second Wednesday of each month. J. Marvin Prewitt, 4141 Lexington Blvd., Corpus Christi, Texas, secretary.

VIRGINIA—Central Virginia Veterinarians' Association, the third Thursday of each month at the William Byrd Hotel in Richmond at 8:00 p.m. M. R. Levy, 312 W. Cary St., Richmond 20, Va., secretary.

Southwest Virginia Veterinary Medical Association, the first Thursday of each month. I. D. Wilson, Blacksburg, secretary.

WASHINGTON—Seattle Veterinary Medical Association, the third Tuesday of each month in the Trinity Episcopal Church, 8th and James St., Seattle, Wash. P. R. Des Rosiers, 5508 2nd Ave., N. W., Seattle 7, Wash., secretary.

South Puget Sound Veterinary Association, the second Thursday of each month except July and August. O. L. Bailey, P. O. Box 906, Olympia, Wash., secretary.

WEST VIRGINIA—Kyowva (Ky., Ohio, W. Va.) Veterinary Medical Association, the second Thursday of each month in the Hotel Prichard, Huntington, W. Va., at 8:30 p.m. Harry J. Fallon, 200 5th St., W., Huntington, W. Va., secretary.

WISCONSIN—Milwaukee Veterinary Medical Association, the third Tuesday of each month, at the Half-Way House, Blue Mound Rd. George F. Lynch, 201 West Devon St., Milwaukee 17, Wis., secretary.

Research indicates that calves as young as 3 months can lose weight on poor feed for three to six months, then make economical gains when again given good feed. —*Agric. Res., July, 1956.*

400 Books About Pets
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100 Page Pet Magazine
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Special INTRODUCTORY OFFER

TWO POUNDS VISTREPCIN **FREE** WITH EVERY 10 LBS. PURCHASED

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PATENT PENDING

A highly dispersible drinking water additive that can be used at both nutritional and treatment levels for swine, poultry and calves.

EACH POUND CONTAINS:

Procaine Penicillin G	1,000,000 Units
Streptomycin Sulfate (as base)	3.0 Gms.
Riboflavin	400.0 mgs.
Calcium pantothenate	600.0 mgs.
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Vitamin B_{12} Activity	1,000.0 mcgs.
Vitamin A (palmitate oil)	100,000 U. S. P. Units
Vitamin D_3	100,000 I. C. Units

(In an inert base.)

INDICATIONS: Bacterial swine enteritis, diarrhetic bacterial calf scours, chronic respiratory disease and blue comb in poultry. May also be used to maintain weight gains by stimulating feed intake.

10-1 pound bottles
or 2-5 pound bottles
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PLUS 2 POUNDS FREE

THIS BRINGS THE PRICE PER POUND DOWN TO $1.79

TRY THE TWO POUNDS, AND RETURN THE TEN POUNDS FOR A FULL REFUND IF YOU ARE NOT COMPLETELY SATISFIED.

ADDITIONAL SAVINGS THROUGH QUANTITY BUYING

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100 Pounds 10%

Two Pounds FREE With Each 10 Pounds Purchased

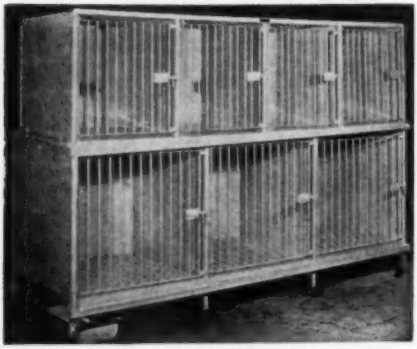
FILL OUT THIS FORM AND MAIL TO: **Diamond Laboratories**
BOX 863 DES MOINES, IOWA

Indicate quantity in multiples of 10 pounds. (Do not include free bottles.)

..... 1 Pound Bottles
..... 5 Pound Bottles

NAME.....
STREET.....
CITY..... STATE.....

DE LUXE CAGES



IMPROVED 7 CAGE DELUXE DRAIN UNIT

The small size is 7½ feet long with 3 — 30" cages in bottom and the large unit 9 feet long with 3 — 36" cages in bottom.

Cages are seamless. Sections can be built in long rows without legs as "BUILT-IN" Cages.

Separate seamless compartments and doors any size. Available in 3, 5, 7, or 12 cage units, or any combination you need.

We don't make all the cages but we make the best.

Write for NEW cage booklet, also DRYER FOLDER

Completely Galvanized Runs Now Available

Baltimore Wire and Iron Works

319 Barrow Street **Jersey City 2, N.J.**

for arthritic diseases

STERANE®

BRAND OF PREDNISOLONE

Intramuscular-Veterinary

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"...striking subsidence of inflammation."

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Commercial Want Ads—$5.00 for the first 25 words, 25 cents for each additional word.

Remittance must accompany ad.

Deadlines for Want Ads

For JOURNAL dated 1st of month — 8th of month preceding date of issue.

For JOURNAL dated 15th of month — 22nd of month preceding date of issue.

Names of classified advertisers using key letters can not be supplied. Address your reply to the key letters, c/o JOURNAL of the AVMA, 600 S. Michigan Ave., Chicago 5, Ill., and it will be transmitted to the advertiser.

Wanted—Veterinarians

Veterinarian wanted for mostly small animal work; must be trustworthy and have pleasing personality. Would consider woman graduate. Permanent with good future. Address "Box S 10," c/o JOURNAL of the AVMA.

Young, single, personable graduate wanted to live in small hospital, West Los Angeles. Requirements: honesty, dependability, sincerity, sobriety, willing to work hard, long hours, including kennel work if needed. Must like people and animals, be patient and understanding, assume responsibility, willing to learn. Fellow veterinarians will respect desire to become good practitioner; only a man desiring a long-term program need apply; not a job, but an opportunity. Small starting salary; good potential. Give full particulars, types of experience. Address "Box V 1," c/o JOURNAL of the AVMA.

Recent graduate with Connecticut license wanted to work as assistant in small animal hospital. Address "Box V 2," c/o JOURNAL of the AVMA.

Veterinarian wanted to assist in small animal practice. Write or call prepared to give full particulars; experience, age, salary, and college. Address Dr. Alexander Slawson, 2414 Amsterdam Ave., New York 33, N. Y.

Leading Middlewest ethical biological and pharmaceutical company has position available for veterinarian in Biological Research Department. Prefer recent graduate with advanced training in research methods as they apply to animal diseases. Ideal working conditions, liberal employee benefits, excellent future. Salary commensurate with qualifications. Our employees know of this ad. Address "Box V 4," c/o JOURNAL of the AVMA.

There are vacancies for veterinarians in regulatory work in Logan and Brigham City, Utah. Annual salary, $5,200 and up. Address "Box S 8," c/o JOURNAL of the AVMA.

Veterinarian wanted as assistant in small animal practice. Address Dr. J. B. Engle, Summit Dog and Cat Hospital, Summit, N. J.

(Continued on p. 40)

Welcome

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Armour Veterinary Laboratories manufactures a comprehensive line of quality drugs for the licensed Veterinarian. These Vet Products are produced under the same quality controls as Armour's world famous line of pharmaceuticals for human use.

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WORLD'S FINEST STAINLESS STEEL OPERATING TABLES

made exclusively for Veterinarians

$279.50
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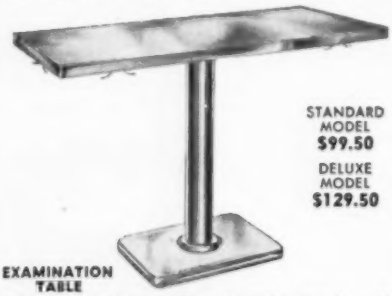
HYDRAULIC OPERATING TABLE

Features precision-made hydraulic unit guaranteed for life of the table. Finger-touch control raises, lowers and locks table in seconds. Large 24" x 60" top. Movable on concealed casters.



STANDARD MODEL **$99.50**

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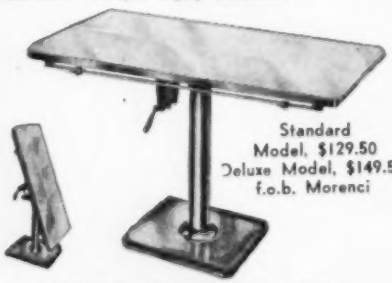
Reinforced stainless steel top in 22" x 48" size. Six tie clamps. Patented "corner compensators" automatically level table on any surface. Designed for examination and pre-surgery treatment.



Standard Model, $129.50
Deluxe Model, $149.50
f.o.b. Morenci

STAINLESS STEEL OPERATING TABLE

Chrome plated single pedestal and base combined with reinforced stainless steel top. Positive locking adjustment in twelve positions. Super size 24" x 60" top.

ALL MODELS AVAILABLE FROM LEADING SUPPLIERS

TED STOCKWELL MFG. CO.
MORENCI, MICHIGAN

(CLASSIFIED ADS—*continued from p. 38*)

Capable veterinarian, licensed in Connecticut, wanted for predominantly small animal practice. State experience, age, and salary expected. Address "Box V 6," c/o JOURNAL of the AVMA.

Veterinarian wanted, preferably recent graduate, for large, long-established, small animal practice in North Carolina. State age, marital status, education, experience, personal data, and salary expected. Address "Box V 9," c/o JOURNAL of the AVMA.

Experienced veterinarian wanted for partnership in swine and cattle practice in better section of Middlewest. Prefer age 35 to 40 and graduate of Texas, Kansas, or Colorado. No real estate. Address "Box V 12," c/o JOURNAL of the AVMA.

To insure prompt delivery replies should be carefully addressed.

Recent graduate wanted for assistant in Maryland small animal hospital; excellent opportunity for advancement and experience. Apartment available. Give particulars in first letter. Address "Box V 15," c/o JOURNAL of the AVMA.

Veterinarian wanted as associate in mixed practice in Vermont; married man preferable with desire for permanency. Hospital facilities with apartment available. Salary plus commission offered. Give age, experience, marital status, and starting salary desired. Address "Box T 5," c/o JOURNAL of the AVMA.

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Position in private mixed practice sought by 1955 graduate who has been employed in government service; veteran, married. Address "Box V 5," c/o JOURNAL of the AVMA.

Experienced, graduate veterinarian wants position with small animal practitioner in Houston, Texas, or vicinity; will consider option to purchase. Married, age 30. Address "Box V 8," c/o JOURNAL of the AVMA.

Recent graduate of Cornell and Angell Memorial desires position in small animal practice leading to partnership or purchase in New York, Connecticut, Massachusetts, New Jersey. Available, October. Address "Box V 10," c/o JOURNAL of the AVMA.

German veterinarian wants position as assistant. Graduated Munich, 1956 (graduates of this year are recommended by AVMA for recognition by State Boards and other agencies); married, age 27. Address Dr. Herbert Schels, Rambergstrabe 4, Munchen 13, Germany.

Veterinarian desires employment in city or state meat inspection work; experienced. Address "Box V 11," c/o JOURNAL of the AVMA.

Experienced 1955 Cornell graduate wants position leading to a small animal partnership. Will be available August, 1957. Can work week-ends until then. Licensed in Connecticut, New Jersey, and New York. Address "Box V 16," c/o JOURNAL of the AVMA.

(*Continued on p. 44*)

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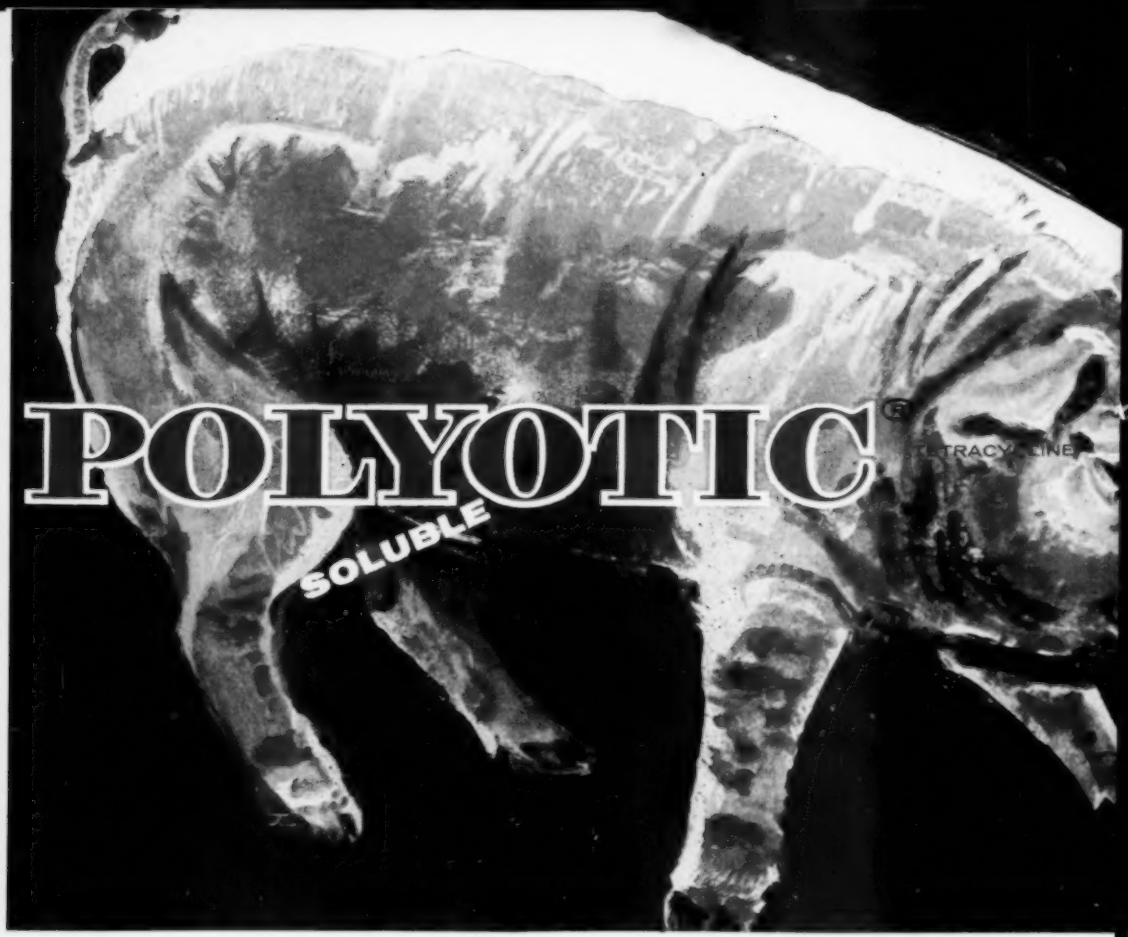

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(CLASSIFIED ADS—*continued from p. 40*)

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Centrally located, well-established, small animal practice for sale in Seattle, Washington; fully equipped hospital, 6-room apartment adjoining. Price, $27,500; lease considered. Address "Box V 3," c/o JOURNAL of the AVMA.

Lucrative, small animal practice for sale in fast growing New England town. Established 20 years; excellent clientele. Comfortable 7-room house, neat kennel buildings, 50 cages, 6½ acres, landscaped, drugs, equipment. Retiring. Address "Box V 7," c/o JOURNAL of the AVMA.

Long-established, large animal practice, grossing $35,000, county seat, good dispensing, for sale with large inventory and home; $25,000. Substantial down payment; balance easy terms. Address "Box V 13," c/o JOURNAL of the AVMA.

Senior partnership for sale in excellent large animal practice in Middlewest. Gross of $53,000 with 47 per cent net. Excellent opportunity; bargain price. Owner has other interests. Address "Box V 14," c/o JOURNAL of the AVMA.

Mixed practice, 40% dairy, for sale in rapidly developing section of central Florida; established 15 years. Hospital and real estate, $10,000 down. Address "Box V 17," c/o JOURNAL of the AVMA.

Small animal practice for sale in southern California; no real estate. Must sell quickly or lease with option to buy; reason, health. Priced within reason within liberal terms. Address "Box L 13," c/o JOURNAL of the AVMA.

Miscellaneous

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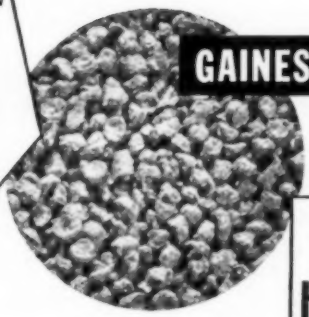

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All requests for hotel accommodations will be handled by a Housing Bureau in cooperation with the Committee on Local Arrangements. The Bureau will clear all requests and confirm reservations.

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1. Blue Bonnet	$3.00-5.00	$5.00-8.00	$.....
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5. Robert E. Lee	$3.50-5.00	$5.00-6.00	$6.00-8.00
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8. White Plaza	$3.25 and up	$4.75 and up	.....

MOTEL	RATES
1. Aero	$7.50-9.00
2. Aloha	$6.00 and up
3. Belvedere	$6.00-10.00
4. Casa Linda	$6.00 and up
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Please make reservations indicated below:

HOTEL

———Single room(s) at $———

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———Twin-bed room(s) at $———

———Suite (specify type of accommodations wanted)

(Three choices MUST be shown)

First choice hotel ———

Second choice hotel ———

Third choice hotel ———

MOTEL

Indicate type of accommodations

(———)
Unit, Cabin,

wanted for ——— persons at $———
No. rate

(Three choices MUST be shown)

First choice motel ———

Second choice motel ———

Third choice motel ———

Arriving on (date) ——— at ——— a.m. ——— p.m.

Leaving on (date) ——— at ——— a.m. ——— p.m.

Will be occupied by (attach list of additional names if necessary).

Your Name (Print or Type) ———

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In calves, Ru-Bac stimulates early rumination. Establishment of an optimal rumen flora in animals raised on milk will promote growth and prevent scours. Ru-Bac is also valuable in promoting weight gains and preventing bloat in feed lot animals.

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Alva offers these 5 advantages:

- **Effective and economical**
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Alva is administered subcutaneously in 2 cc doses. Exposed or infected swine may be given anti-swine erysipelas serum simultaneously. Swine held beyond normal market period, or breeding stock, should be revaccinated.

"Better Biologics for the Graduate Veterinarian"

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